

Sun or Ski Vacation Homes Page 176

POPULAR MECHANICS

OCT. 1969
50 CENTS

Great Ideas
From the
World's Biggest
Inventors
Show

In Color! '70 Cars

**Amazing New
Instantaneous
Fire Extinguisher**
For Your Car, Boat
Or Home



**Build
PM's Graceful
Grandfather's Clock** Page 124

**What's New
In Snowmobiles
And Outboards**

Insulating Your Home: What to Use and How to Use It

Dan Gurney Answers Your Questions on Racing and Driving

Oneida...the boot that took Antarctic punishment in stride



Glacier-hopping on perilous Heard Island, this explorer wears Oneida for warmth, safety, comfort.

You probably won't ever sail a small vessel through sub-antarctic waters to a treacherous, weather-blasted island and climb to the summit of a storm-swept volcano.

But it's nice to know Red Ball Oneidas can take that kind of punishment!

That's why Oneida, the fully insulated boot that conquered cold, repelled water, resisted wear, required no maintenance and gave solid comfort to members of an Antarctic expedition—is the best boot for you.

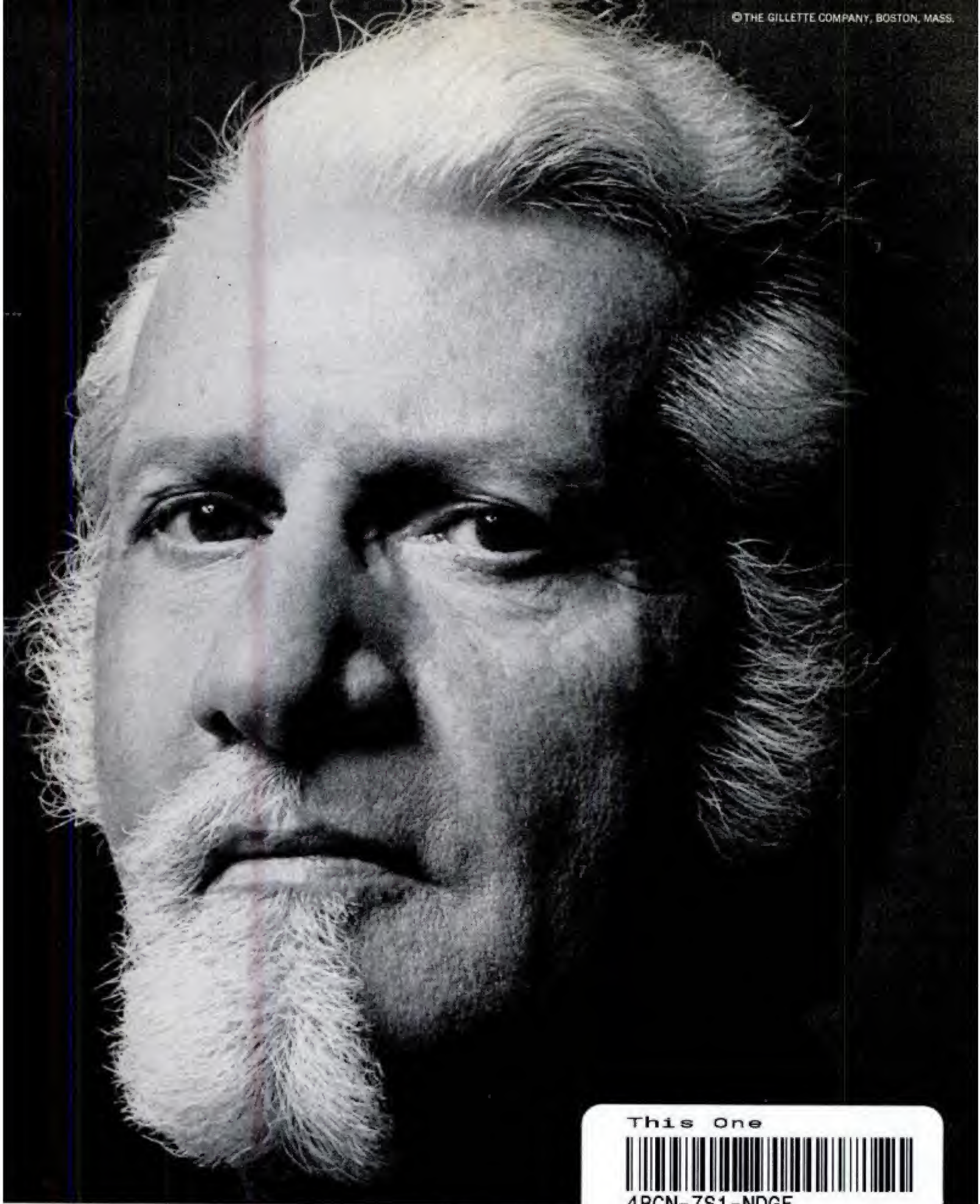
Buy a pair and do your own exploring!

 **Red Ball Oneida**

Look for the Red Ball by Ball-Band, Mishawaka, Indiana

For dealer in your area call 800-243-6000 at no cost. In Connecticut, call free, 800-942-0655





This One



4RCN-7S1-NDGF

Once you start using Gillette Super Stainless Injector Blades it's very hard to stop.



(Coated with the miracle plastic that reduces pull.)



A typical Dodge "Job-Mated" van interior for general service, showing some of the equipment available to make your job easier. Choose the equipment to do your job right, from a wide selection of shelves, drawers, bins, baskets, and many others.

It all started with the hot-selling Dodge compact van. And now, its versatility has been extended to eighteen "Job-Mated" units like the one shown below, outfitted to handle the needs of just about any trade. And you can order your Dodge Tradesman Van with options such as air conditioning, power steering, or automatic transmission. Only Dodge offers power steering on compact vans. Proof again that Dodge Truck is first with the most.

RACK UP ANOTHER FIRST FOR DODGE.

Dodge Tradesman Van is here with specially installed interiors to meet your business needs. If you're in a business requiring a compact truck built for general service duty, there's a Dodge "Job-Mated" Tradesman equipped to make your job easier, more efficient. See the Dodge "Job-Mated" Tradesman, the hottest idea in trucks since the compact van.

DODGE TRADESMAN PUTS YOUR BUSINESS ON WHEELS

TO: Advertising Department, Dodge Truck Operations, P.O. Box 2088, Detroit, Michigan 48231

Please rush me a copy of your new Dodge Tradesman Van catalog. I want to know more about them.

Name _____

Address _____

City _____

State _____

Zip _____



Dodge



**“I didn’t know what
a blitz was until
I splashed on
your after shave.”**



Even your beefiest blockers can't protect you if you're not careful how you use Hai Karate® After Shave and Cologne. It's like being gang tackled by eleven love-starved linebackers. So make sure you read the instructions on self-defense which we include in every package. And don't oversplash. Or you might lose a lot more than yardage.

Hai Karate-be careful how you use it.



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AUTOMOBILES AND DRIVING

- 22 Drivin' With Dan
- 44 Detroit Listening Post
- 72 New Mercedes Sports Car
- 92B Automobile Clinic
- 93 Amazing New Instantaneous Fire Extinguisher
- 104 The '70 Cars: What's New Depends Upon Your Point of View
- 107 The Really New Ones
- 110 The Compacts
- 112 The Intermediate Cars
- 115 The Personal Cars
- 119 The Favorite Family Cars
- 123 The Luxury Cars
- 154 Saturday Mechanic: How to Stop a Dieseling Engine
- 260 The Man Who Made Bentleys

HOME AND YARD

- 92F Homeowners' Clinic
- 124 PM's Handsome Hall Clock (Part 1)
- 164 Weekend 'Thinwall' Projects
- 168 Instant Cement Fills Cracks for Good
- 170 Which Insulation Should You Use?
- 176 All-Season 'Ski Lodges'
- 181 Now: A Vacation Home in Three Hours
- 182 Exciting New Products
- 184 How to Install a Wall Safe
- 188 Solving Home Problems
- 190 Update Your Heating System

BOATING, OUTDOOR RECREATION

- 14 New Starcraft Coach
- 41 What's New Outdoors
- 52 On-the-Go Camping
- 100 '70: A Fine-Tuning Year for Outboards
- 142 '70: A Sensational Year Coming Up for Snowmobiles

REGULAR FEATURES

- 6 Letters

SHOP AND CRAFTS

- 124 PM's Handsome Hall Clock (Part 1)
- 164 Weekend 'Thinwall' Projects
- 169 Hints From Readers
- 175 Hints From Readers
- 187 Make This Hinged Fixture for Your Radial Saw
- 192 New Tools You Should Know About
- 193 Hints From Readers
- 194 How to 'Plane' on a Lathe
- 198 Dent Puller From Pipe Parts
- 199 Hints From Readers
- 200 You Can Build a Lightweight Press for Heavyweight Jobs
- 204 The Handiest Tool in Your Shop! PM's Master Shop Guide

SCIENCE AND INVENTIONS

- 20 Science Worldwide
- 93 Amazing New Instantaneous Fire Extinguisher
- 130 Patexpo '69: PM's Exclusive Preview of World's Biggest Inventors Show
- 138 Mechanics of Medicine: A 200-mph Surgical Drill, Steady Beep of a Heart Monitor, Electronic Voice Box

ELECTRONICS, RADIO AND TV

- 146 For Tops in Hi-Fi Listening: Now It's Back to Earphones Yet!
- 248 New in Electronics

PHOTOGRAPHY

- 158 New in Photography
- 160 Zoom Your Way to Bigger, Better Pictures

SPACE, AVIATION, MILITARY

- 96 Now: 'Hands Off' Landings on a Carrier

NEXT MONTH IN POPULAR MECHANICS

Build a 3-Bedroom, 2-Bath Airconditioned House for \$7500. An Indiana family did!
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How to Winterize a Camper. One of several features to get you ready for winter.

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OCTOBER 1969

86 Proof Early Times Distillery Co., Louisville, Ky. ©1968



let's make it

Make yourself the greatest home bartender in town. Just send \$3.50 to Early Times Glass Offer*—P. O. Box 1080, Louisville, Kentucky 40201. We'll send you a set of 6 Giant 15 oz. Early Times Jiggers. Or send \$3.00, for a set of 8 Early Times 10½ oz. Highball Glasses. They're beautiful, so get both sets while they last. Do it now.

*offer valid only where legal

THE TRUE OLD-STYLE KENTUCKY BOURBON



Revelation hasn't changed since Gramps helped make "The Perils of Pauline."

Revelation's not made of sugar and spice, boys. Just tobacco: 5 great tobaccos. Revelation's for the experienced pipe smoker.



A quality product of Philip Morris U.S.A.

LETTERS

TO THE EDITOR

Versus Maverick

In Bill Kilpatrick's article, *Maverick Versus the Mob* (page 73, Aug. PM), Ford's Maverick is seen as posing very little threat to the economy imports because it lacks their uniqueness.

As a happy Volkswagen owner, I've been following Detroit's concern and breast-beating over import sales with amusement. What most American cars lack tragically and what cars such as Volkswagen enjoy in abundance is quality of workmanship. Economy, price, maneuverability—these are all icing on the cake.

Workmanship is not a luxury. It is an essential mark of quality merchandise.
CLIFTON, N.J. REV. JOHN MAIORANA

You stated: "Maverick offers more room, more power, a bigger trunk . . ." I'm sure that if you'd look again, you'd find that the Renault 10 has a bigger trunk than the Maverick, more front headroom and more front-seat legroom. As for Maverick's higher power—seems to me buying a more powerful car defeats the purpose of buying economy.

5TH SPECIAL FORCES SGT. D. K. KRETZINGER
VIETNAM.

Cannon builder

I have just completed the scale model of the 24-pounder from the main battery of the U.S. frigate *Constitution* (Model This 24-Pounder, page 134, Feb. PM). I found this a challenging project.

I thoroughly enjoy reading your maga-



zine and think it is a tremendous inspiration to die-hard model builders.

OTTAWA, ONT.

JOHN F. BRYDGES

No bars in Fort Worth, either

In *Zoo With Invisible Bars* (page 111, Aug. PM), you stated that in the Antwerp

(Please turn to page 8)

POPULAR MECHANICS

Are you still working for peanuts while others are making it big?

Why put up with a dead-end job and low pay while other men forge ahead to exciting promotions and big incomes?

There are more key positions waiting around today than there are people to fill them. Do you know how easily you can train for one of these positions? You can do it without giving up your present job, or going back to class.

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their former salaries. Frequently students report big increases during the first year of training. You can do the same.

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training is in experienced hands. Your LaSalle diploma is a credential you can be proud of.

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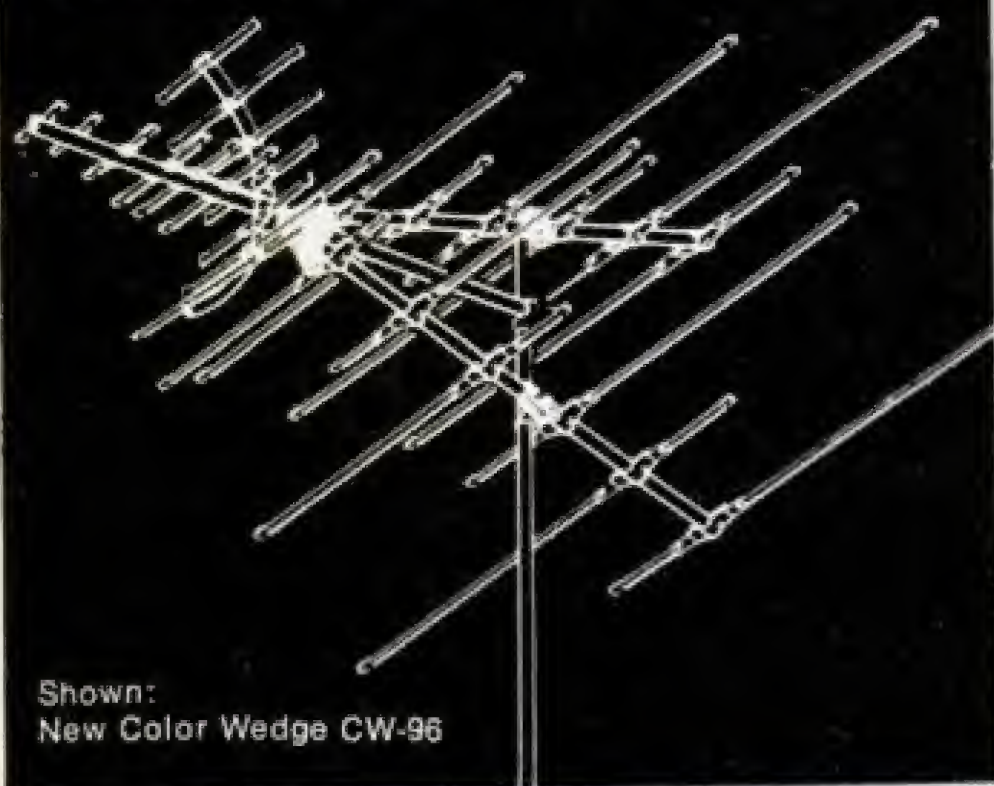
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Winegard announces everything you need to make color tv sharp and clear!



Shown:
New Color Wedge CW-96

Maybe all you need is a special made-for-color Winegard antenna. Like, say, one of our totally new Color Wedge models.

As you can see, the Color Wedge looks different than other antennas. It has a new electronic design that makes it work better on all channels. And it has a new mechanical design that makes it last years longer regardless of rain, ice, high winds and the like.

The unique "wedge" design provides greatly increased vertical capture area in a much shorter, more compact antenna. This means your TV set receives increased signal for sharper, clearer color reception. Even on those weak, hard-to-get channels. And it means that ghosts, snow and other TV interferences are drastically reduced or eliminated.

New truss construction makes Winegard Color Wedge the strongest antenna around. It's permanently weather-protected by the genuine gold anodized finish. Just like the TV wire connections are protected by the exclusive built-in cartridge housing.

In addition, Winegard supplies fine quality antenna mounts, TV cable, and everything you need for a convenient, plug-in home TV antenna system.

For sharpest, clearest TV—no matter what kind of set you own—see your Winegard dealer. Or write for our giant new catalog. It's free!

Solid state
home TV
system
amplifier.



Winegard
® ANTENNA SYSTEMS

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BURLINGTON, IOWA 52601

LETTERS

(Continued from page 6)

Zoo, birds stay in their unbarred cages because the area outside, where the visitors stand, is dark, and the birds won't leave their lighted cages.

There is the very same type of cage at the Forest Park Zoo in Fort Worth, but in a larger display. It has been here for several years.

FORT WORTH, TEX.

KENT RAY

His cup of tea

I have sailed my version of the *Teacup* (*A Basic-Basic Sailboat*, page 146, Jan. 1966 PM) on Jackson Lake, Wyo., on lakes here and across San Francisco Bay and have never turned it over.

I used the recommended sail and added a jib. I intend to purchase a larger main later on. I used a different seating ar-



angement than you showed, made the stem and stern of double thickness, added more bracing and fiberglassed the hull.

SUNNYVALE, CALIF.

KENNETH S. FERRIN

Outboard tune-up

In your *Outboard Service Guide No. 2: How to Check Out Your Starting System* (page 132, Aug. PM) you show that special tools are needed to insert the spring in the

(Please turn to page 10)

Krylon spray chart: something to keep at your fingertips.

Krylon® Spray	Description	Uses
Decorator Spray Paints	sprays on evenly; baked-enamel finish; contains Rust Magic®; comes in over 45 colors.	can be used indoors or outdoors. On wood. Rust Magic makes it especially good for metal.
High-Heat Resistant Spray Paint	withstands temperatures up to 1200°F; comes in 4 colors: Aluminum, Black, White, Red.	for painting anything exposed to high heat—steam pipes, boilers, furnaces, ovens, radiators, motors, etc. Also can be used on barbecues.
Car Colors	special formula for auto body painting; comes in wide variety of standard auto colors.	for touch-up work on scratches, covers larger areas after collision repair too. Also good for small home decorating jobs where the wide variety of car colors is desirable.
Automotive Trunk Paint	long lasting and scuff-resistant; covers scratches, scars, soil; gray/white spatter finish.	makes trunk interiors factory-fresh.
Engine Spray Paint	heat and oil resistant; prevents rust; comes in 12 colors.	for refinishing engines and transmissions; also good on steam pipes, radiators, boilers, etc.
All-Purpose Primer	sprays on smoothly to hard finish; may be topcoated with or without sanding; can be covered with almost any finish; colors: white or gray.	a primer for plastics, ceramics, metals, rivets and bolts. Also good on wood.
Rust Magic Metal Primer	penetrates to prevent further rust corrosion; flexible—permits expansion and contraction of metal; recoatable with most finishes.	for general indoor or outdoor use.
Zinc Chromate Primer	hard finish; inhibits rust; can be topcoated with or without sanding; colors: yellow, green.	best for outdoor structural or ornamental work—for galvanized and other white metal surfaces.
Hot Rod Primer	special formula automotive primer; hard, smooth finish is lacquer resistant; can be covered with almost any finish.	best for automotive refinishing; can be used as regular auto body undercoater; also good on sheet metal and cast-iron surfaces, on wood, plastic, ceramic or masonry.
Auto Body Undercoater	tough coating resists rust, road salts, alkali, acids; won't chip or crack; deadens sound.	also good for sealing rain gutters and roof cracks.
Crystal-Clear	a non-yellowing acrylic spray coating; long-lasting; water-resistant; won't crack or dry; high dielectric strength.	electronics: keeps lead-in connections tight; prevents corona in high-voltage sections. general use: protects blue-prints, drawings, etc. Also prevents tarnishing of brass, copper and other metals.



Free. A guide to gluing, taping and spray painting. Mail a stamped, self-addressed envelope to: Borden Inc./Chemical Division, Dept. B-2, 350 Madison Ave., N.Y., N.Y. 10017.





The Death Valley Test.

Some of the guys at our advertising agency wanted to find out for themselves if our *Better Pouch* is as good as we say. So they buried one—in the middle of the desert. Then five months later they dug it up. And smoked the still-fresh pipe tobacco inside! How did it stay fresh so long? The pouch is sealed. Air-tight. Nothing gets in or out. But don't you take our word for it either. Get a FREE pouch of Kentucky Club Mixture and see for yourself. Just send us the coupon, and an empty pouch of what you're now smoking (any brand but ours). And get a fresh start with our *Better Pouch*.

FREE OFFER TO PIPE SMOKERS

Mail to: Fresh Tobacco, Box H
Wheeling, W. Va. 26003

Gentlemen: Here's my ordinary pouch. Now I'd like to try a full-size package of Kentucky Club Mixture with that sealed-in freshness you promise.

Name _____

Address _____

City _____

State _____ Zip _____



Offer good in U.S.A. only, and expires January 31, 1970. Sorry, only one to a customer.

LETTERS

(Continued from page 8)

housing on manual starters. Actually, it is far easier to put the hook of the spring on the pin of the housing and wind it in the housing. Then bend the spring slightly to allow the pulley to go in. It is then simple to rewind the pulley to the necessary tension.

BROOKLYN, N.Y.

BRUCE CAVANAGH

After reading Outboard Service Guide No. 1: *How to Check Out Your Ignition System* (page 138, July PM), my advice to readers is to scrap the outboard causing the trouble and buy a brand-new one. Why?

Well, Henry Notrom advises the purchase of a \$15 flywheel puller and a \$120 magneto analyzer. When you get your old motor all tuned up, you scrap the equipment purchased to tune it up and what have you got?

WATERBURY, CONN.

JAMES B. WALKER

Well, you've got a motor that's running again plus equipment to tune it up the next time (why scrap it?). You've also got an idea that it will cost some money to do the job right.

Brush Buggy builder

Here's a picture of the Brush Buggy (*Build a Brush Buggy*, page 132, Nov. '68



PM) I built with the help of my dad. It was a lot of fun making it, and its performance is something else! Thanks for a fine magazine; keep the great articles coming. SILVER LAKE, MINN.

JOHN MALLAK

Any other readers who yearn to zoom off into the brush—and who don't have the November issue on hand—can order Xerox copies of the Buggy article for \$1.20. (Or the cannon on page 6 for \$1.40 and the sailboat on page 8 for \$1.80.) In fact, we'll Xerox any past article for 20 cents a page.

PM also has lots of books and large-size plans for projects; we'll send a catalog of them for 25 cents for handling and mailing.

Order from: Bureau of Information, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. ★★

100%

more mileage on this new Atlas tire.

**Proven against complete sets
of two-ply tires that came on
most '69 cars.**

Results of these tests against two-ply original equipment tires for most 1969 cars showed that you'll get twice the mileage with the new Atlas Plycron 2 plus 2*.

Polyester / Fiberglass Construction

This rugged "tread-saver" construction helps reduce scuff and squirm. Just one of the many reasons why the tread lasts and lasts — twice as long.

Extra resistance to cuts and punctures

Our combination of fiberglass belts and blended chlorobutyl liner gives you extra resistance to cuts and punctures. See your Atlas dealer soon. And get 100% more mileage on the new Atlas Plycron 2 plus 2.

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Atlas Tires • Batteries • Accessories
Sold at over 50,000 leading service stations.



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“With a 16-to-1 ratio, the pressure on them is to shatter bricks. We’re tough on spark plugs.”

Clint Brawner and Jim McGee were co-chief mechanics for Mario Andretti’s record-busting 1969 Indy 500 championship car. When these experts talk, it pays to listen.

“The heat and compression in our turbocharged Ford engine is tremendous,” says Clint Brawner. **“Our Autolite plugs have to survive 37,000**

brick-busting ignitions a minute. Yet I’ve never seen one fail.”

Autolite spark plugs have a special hermetic seal that prevents compression loss under all operating conditions. They stay sealed despite extremes in heat and pressure.

“Racing may be hell on plugs. But you’re tougher,” says



Co-chief mechanics Jim McGee, left, and Clint Brawner beside Mario Andretti's turbocharged Ford 1969 Indy winner.

Autolite plugs in our Indy winner was enough But you're tougher on yours."

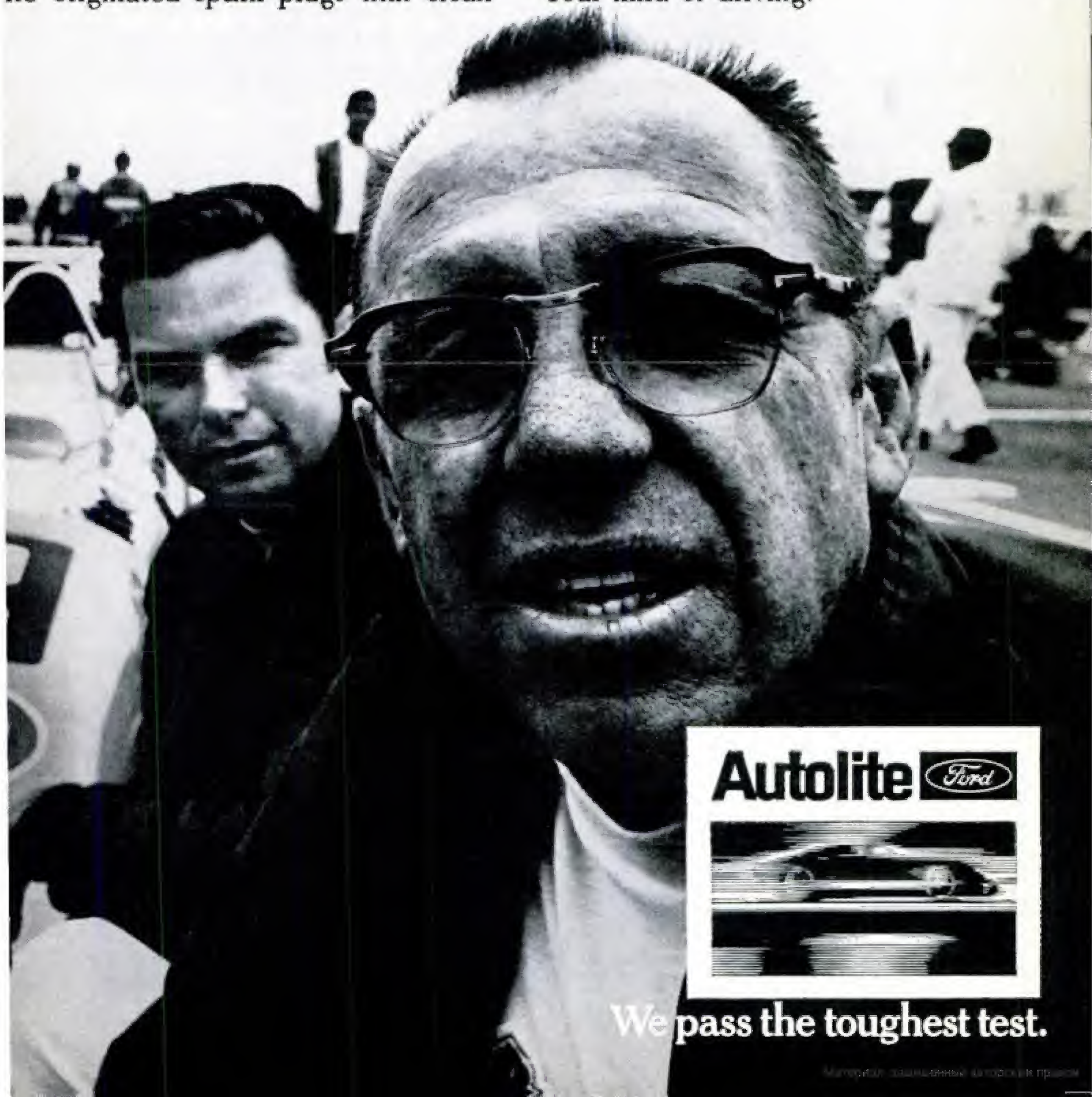
Jim McGee. "When you crawl in traffic, ash deposits build up in the cylinders. Then you speed up, and those deposits splash around and heat bakes them onto the plug tips. You get shorts. Lose power. Waste gas."

With Autolite, no problem. Autolite originated spark plugs that clean

themselves. Their extended Power Tips reach down into the hottest engine gasses. Fouling deposits are burned off before they get a chance to build up.

"You got clean plugs, buddy, you got max power."

Next time ask for Autolite spark plugs. They pass the toughest test in racing. And the toughest test there is. Your kind of driving.



Autolite 



We pass the toughest test.

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25 KITS SENT TO BUILD THIS
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in service, check GI line in coupon

A better job, top pay and steady work are easily within your reach. Learn to repair and install air conditioning systems, refrigerators and freezers. Air conditioning is one of America's fastest-growing industries. Millions of autos and homes are being air-conditioned. The need for trained men is immediate and great.

Make Home Your Training Center—Learn by practicing. CTI sends 25 kits of tools and parts to build a complete refrigeration system—which you later convert into a refrigerator or freezer. The course is easy!

Earn Money As You Train—Since the CTI course includes training with real equipment, many students earn money repairing units soon after enrolling. On completing training they go into top pay jobs. Many get started in their own business.

Mail Coupon Today for FREE book. No obligation. Prove to yourself that the air conditioning, refrigeration and heating field is best for you—the easiest training to master and loaded with top pay opportunities.

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New Starcraft Coach



THERE IS A DEFINITE TREND toward fiberglass in RV housing. Starcraft is the most recent company to announce production of a luxury liner molded from this material. Still being tested and refined at the Goshen, Ind., headquarters, the Starcraft 19-foot motor coach comes equipped with wall-to-wall carpeting, wood-grain cabinetry and wardrobe, gas-electric refrigerator, range and oven, all-fiberglass-molded marine head with shower and dinette seats which can be faced forward for traveling or folded down for a double bed. The gaucho can also be converted into a second double bed. The base price of \$9995 does not include such comfort options as airconditioning and an AM-FM stereo with tape deck. ★★★



START YOUR NEW CAREER NOW! WITHOUT OVERHEAD! ANY PLACE! ANY AGE!

UPHOLSTERING JUST ONE

you don't even have to quit your present job!!!

CHAIR can pay you as much as your present weekly paycheck!

Start learning now. At home, or in the garage, in your spare time — no outside classes to attend. If you can tie a knot and drive a tack, you can learn this business, quickly, easily. You start learning the basics right away through the proven MUI Home Training Plan. And before you're barely into it, you can start doing the simple upholstery jobs that are all around you waiting to be done. Chairs, cushions, seats, footstools. Even before MUI students finish their training, people start bringing upholstery jobs to them, and remember—the world is full of furniture that needs fixing and re-upholstering and more is wearing out all the time!

"What started as a hobby, now pays me \$10 an hour"

Yes, many MUI graduates make better than \$10 an hour turning old wornout furniture into bright new decorator pieces! **Stack it up against what you're doing now!** Are you making \$150 a week? \$200? \$250? Do you put in long hours of dull work, with small raises? Is that the way you want to spend the rest of your life? Just imagine, you can make \$150, \$200, \$250 upholstery just one chair or sofa these days! And if you're the kind of person who likes to work and earn, you can sometimes finish a job like this in a day. That's pay, ... and it beats what most college graduates make!

AS YOU LEARN, YOU JUST SLIP INTO THE IMMENSE FLOW OF UPHOLSTERY WORK!

Think of all there is! ... Sofas, lounging chairs finished in beautiful fabrics, which MUI tells you how to get at the right price — even leather and all the new vinyls. And then you have built-ins and breakfast nooks, boats, trailers and all the millions of automobiles in America. Yes, you learn all this and more! When we finish teaching you, (in your own home in your spare time) and when you get our California state approved diploma, you know this business ... as a real professional! You will then have one of the most fantastic moneymaking skills in America built into your head and hands! No one can ever take this skill away from you ... and no one can ever fire you, because you're the boss of a business that you can take with you ... You can make big money from then on ... any time, anyplace you want to put out your shingle!

When you read the papers you see there's a strike here, a lockout there. Detroit lays off 150,000 men. A plant is shut down and moved out of state. A new automated machine eliminates 5,000 jobs. They talk about dislocated workers and try to do something about it. What pays the bills if you get caught up in one of these situations? When you know upholstery, life gets very simple and lots of fun. It's simple because where there are people, there are upholstery jobs and lots of them. It's fun because life is fun when the bills are paid and there's money in the bank, even enough to buy those things you've always wanted for yourself.

MUI IS APPROVED BY THE CALIFORNIA SUPER-INTENDENT OF PUBLIC INSTRUCTION AND IS AUTHORIZED TO ISSUE A DIPLOMA IN UPHOLSTERY.

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WORK THE HOURS YOU LIKE TO WORK!!

If you favor a regular 35 hours a week, upholstery lets you do it and make a really fine living. On the other hand, if you're really ambitious and want to work 60 or 70 hours a week, you are starting to talk about some big, big money! The important thing is that the choice is yours, not somebody else's! (Not like when you're working for someone else.) Many students of retirement age just do a few pieces now and then just to keep things nice and comfortable.

TO GET STARTED, JUST GET THE COUPON IN THE MAIL ... TODAY!

It costs you nothing to get the information and there's no obligation. No salesman is going to call you. This much and this much only, every successful MUI graduate must do for himself — send the coupon today!

YOU'LL GET A BIG ILLUSTRATED 32 PAGE BOOK ON UPHOLSTERY

and the upholstery business, and an actual free sample lesson showing how the fabulously successful MUI system is taught. For your sake and the sake of your future, do it now. Cut out the coupon, fill it out, put it in an envelope and mail it now. Air mail reaches MUI about two days sooner!

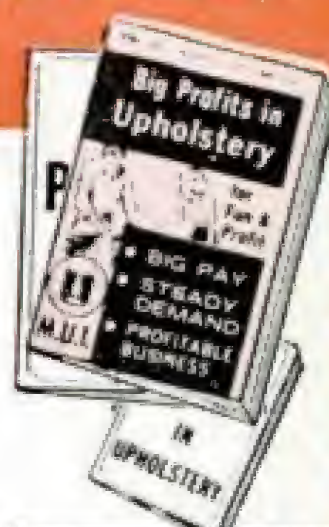
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Please send the **FREE UPHOLSTERY CAREER BOOK**, the **FREE SAMPLE LESSON**. I understand I am under no obligation whatever and am just sending for the free facts on job and career opportunities in Upholstering and the MUI home training program. I understand that no salesman will call.



APPROVED FOR VETERANS

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I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish*! And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned*! I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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The deaf can "see" messages and the blind can "feel" them on the Code-Com, a new instrument developed by Bell Telephone Laboratories for people who are totally deaf, deaf and blind, or deaf and mute. The device, which connects with a conventional phone, converts messages into flashes of light and into vibrations that can be felt when the user puts his fingertips on a small disc. A sending key, worked like a telegraph key, permits mute users to send messages. Calls from conventional phones can be received if the caller talks in Morse code: "dit" for each dot, "dah" for each dash. After some practice with Morse code, handicapped users of the Code-Com were able to attain sending and receiving speeds of about 10 words per minute, according to Bell Laboratories. Field trials are still in progress.

Wallaba is "one of the most rot-resistant woods ever examined" at the U.S. Forest Products Laboratory, Madison, Wis. In the event you've never heard of it, wallaba comes from French Guiana. It was tested along with 14 other exotic species by researchers who were looking for woods that can provide long outdoor service where the decay hazard is high. The scientists also gave high ratings to ekki, a tropical African hardwood, and jarrah, an Australian hardwood. The rot evaluations are part of a program of determining the strength, machineability and other properties of foreign woods to establish those best suited for importation here.

Sound waves provide an assist in unloading powdery cargoes—grains, chalk, iron ore—from large containers. The usual unloading method is to blow the powders out with a powerful stream of compressed air. But this frequently creates the formation of powdery arches that have to be broken up, stalling the process. A Swedish company reports that sound waves, projected into the container, quickly knock down the troublesome arches.

Air pollution accounts for that beautiful blue haze associated with the Smoky Mountains in Tennessee and North Carolina. So says Dr. Paul Story, a professor of chemistry at the University of Georgia, who explains that pine trees are the cause. During growth, the pines exude volatile hydrocarbons that react in sunlight to form other substances. Many of these compounds mix with water droplets to create the small particles of matter that comprise the smoke of the Smokies.

A "spin off" of Apollo 11's success last July was the \$1000 reportedly won by Dr. Fred L. Whipple, director of the Smithsonian Astrophysical Observatory, Cambridge, Mass. In 1960 Dr. Whipple bet a Viennese physicist that before 1970 man would set foot on the moon and make a safe return to Earth. Dr. Whipple's interest in and enthusiasm for a moon-landing project predates his big bet by many years. In 1952 he contributed to a series of articles in *Collier's* telling how man could achieve such a feat. If you want to know how that '52 blueprint (drawn by Dr. Wernher von Braun and Willy Ley in addition to Dr. Whipple) stacks up against actuality in '69, read *The Dream Comes True* (page 80, July PM).

Creation of a new, tamperproof computer is the goal of a project at Case Western Reserve University, Cleveland. Such a computer is needed, according to Prof. Edward Glaser, project director, because more and more government secrets and data about private individuals are being stored in computers, which can possibly be "tapped" by unauthorized persons. The new computer will incorporate safeguards that signal if the machine has been tampered with. A key member of his design team, says Prof. Glaser, is another computer.

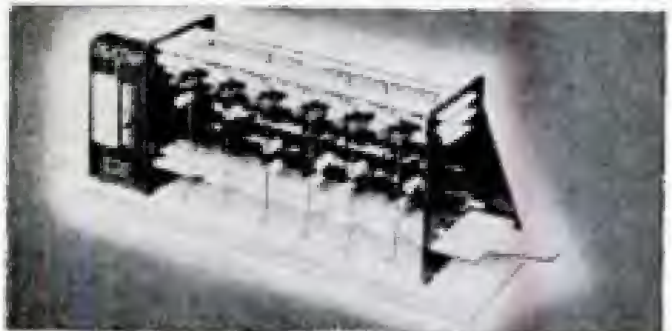
An instrument for spotting mineralized rocks on the sea floor is now being lab-tested by scientists of the U.S. Geological Survey. The "finder" is a pipelike cylinder that contains radioactive californium-252. Lowered into a tank of seawater, the finder irradiates rock samples, "exciting" minerals in the rocks. The minerals begin to emit gamma rays, which are analyzed and identified. Different minerals have different gamma "signatures." The finder, which could be used in prospecting, is slated for deep-sea tests in about a year. ★ ★ ★



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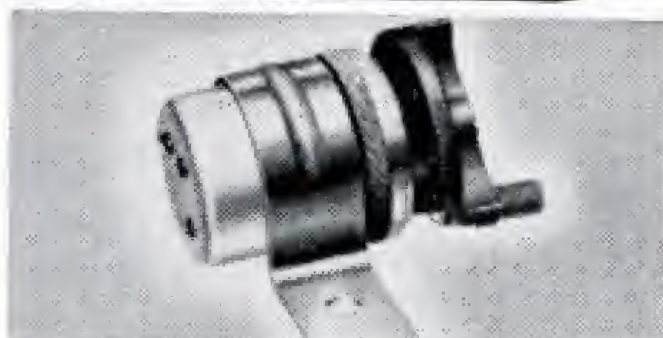
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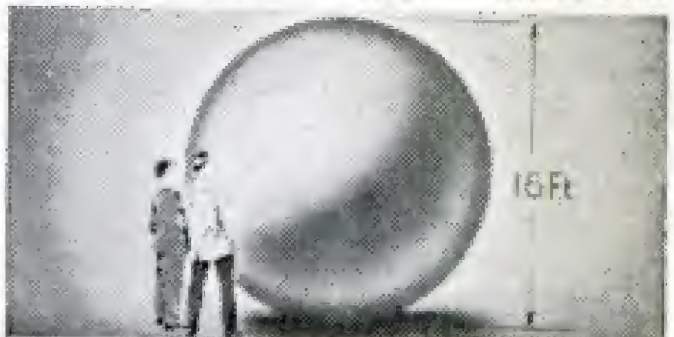
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What make of car has won the most NASCAR Grand National races? Should a 16-year-old drive a street motorcycle? Does airconditioning cut engine power? Dan Gurney answers these and other automotive questions



MOON MEN have nothing on race drivers when it comes to protective outfitting. Here Dan dons flame-proof gloves before test lap at this year's Indy 500

Q. Now that wings have been banned from Formula 1 Grand Prix racing, is there any type of racing where they are still allowed?—Dan Wilson, Cleveland.

A. The full-fledged wings to which you refer are still eligible in Can-Am Group 7 racing and in the Formula A Continental Championship, both sanctioned by SCCA. In addition, spoilers of considerable size continue to be used in most other types of racing.

Q. What make of car has won the most NASCAR Grand National races?—Bobby Catlin, Charleston, S.C.

A. According to NASCAR records from 1949,

the first year of Grand National racing, through the last event in 1968 Ford is the runaway leader with 237 victories. Then come Plymouth, with 139; Chevy, 114; Oldsmobile, 87; Hudson, 79; Pontiac, 69; Dodge, 64; Chrysler, 59; Mercury, 25; Thunderbird, 6; Lincoln, 4; Studebaker, 3; Buick, 2, and Nash, 1. Biggest single year for any make was Ford's 1965 season when it won 48 of 55. Next biggest years were Plymouth's 1967, with 31 wins in 49 races, and Pontiac's 1961, with 30 victories in 52 events. And, would you believe that Hudson won 27 of 34 in 1952?

Q. Is the new track at College Station, Tex., supposed to be a drag strip or Indianapolis-type layout?—Leroy Roberts, El Paso, Tex.

A. The College Station plant—Texas International Speedway—is to be a major racing facility based on a two-mile oval, but including a road course. Its first event is scheduled for Nov. 9 and plans call for major stock-car, USAC championship, and sports-car races. Although I imagine TIS will also stage some drag-racing events, I believe you may be thinking of a new drag-racing facility in the Dallas area.

Q. Since you run both types of racing, can you tell me the basic difference between Can-Am cars and Indianapolis cars?—Aaron Hollander, Stamford, Conn.

A. You can run any kind or size of internal-combustion reciprocating engine in Can-Am, but you must run on gasoline. At Indy, about the only thing you have freedom on is fuel. Any kind is okay. Can-Am cars have bodies which envelop the wheels. Indy cars don't. Can-Am has no minimum weight or maxi-

(Please turn to page 37)

Ed Crouch Never Dreamed He'd Earn Up To \$2,000 A Month When He Mailed The Coupon



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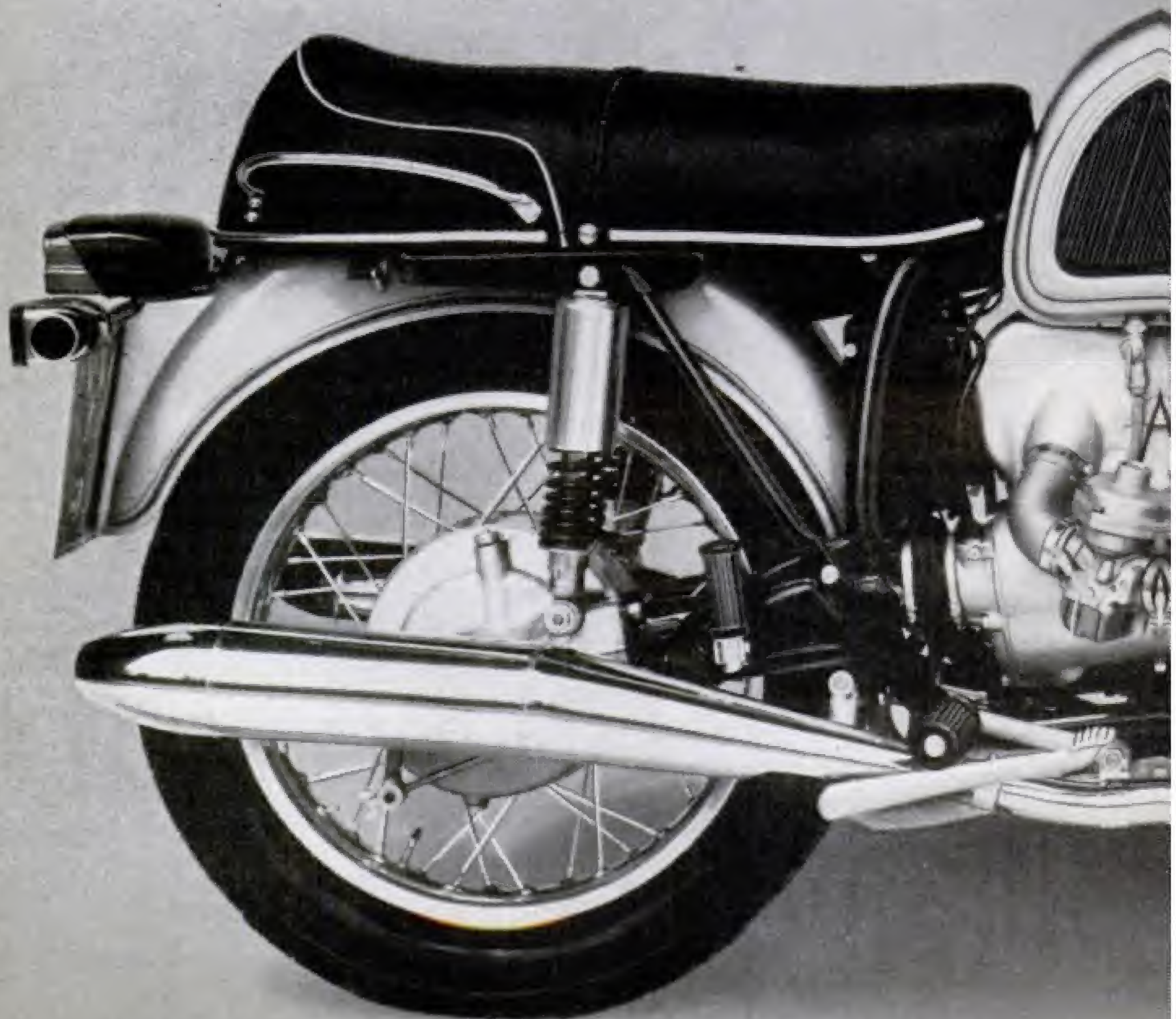
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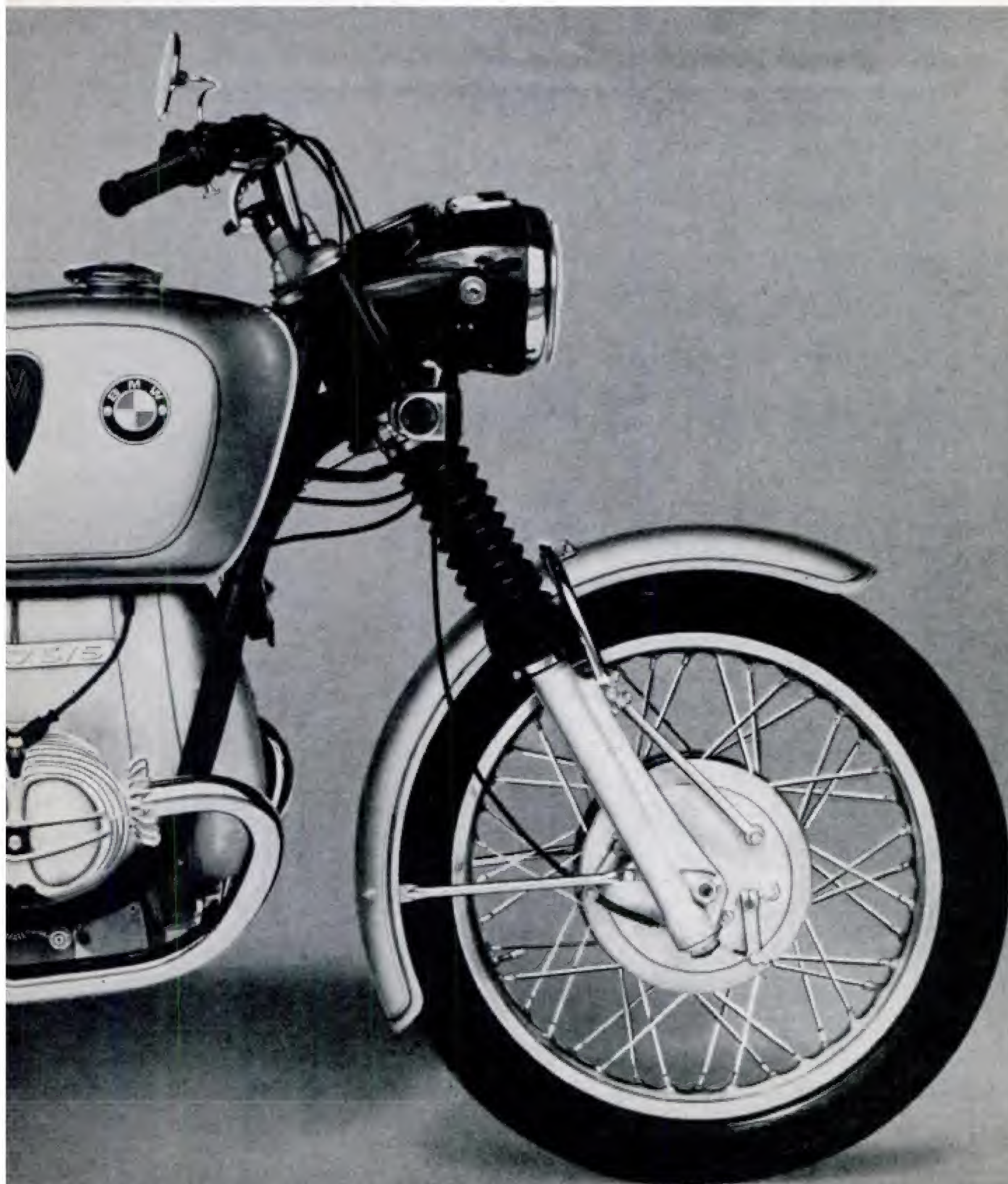
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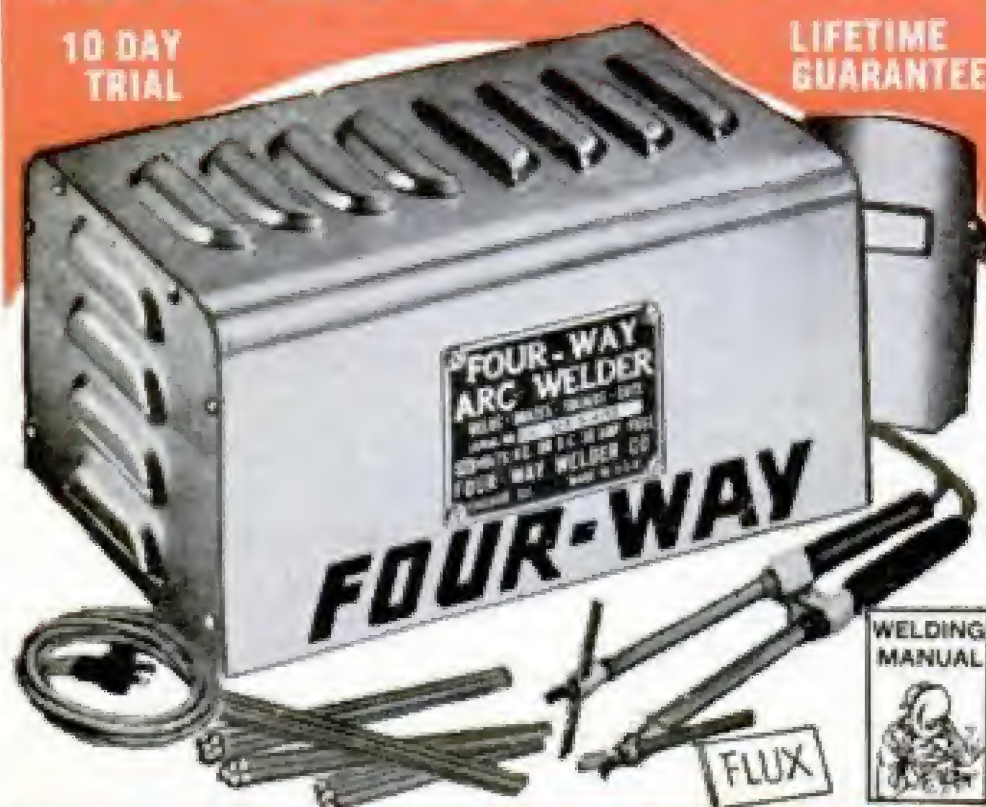
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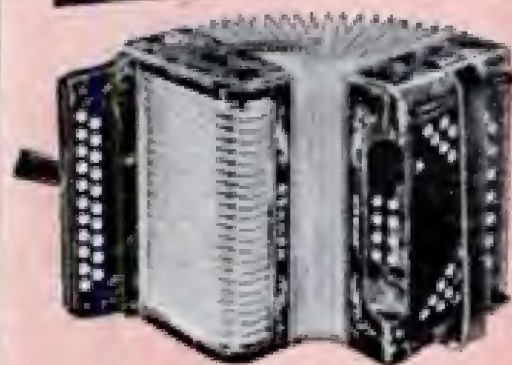
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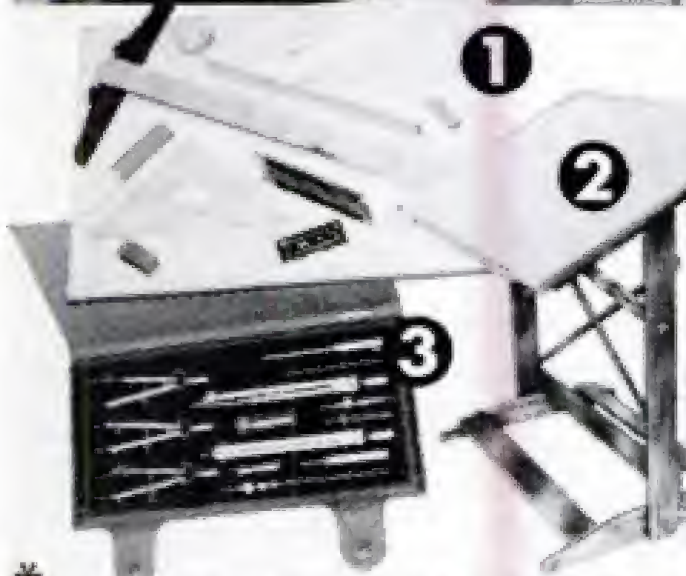
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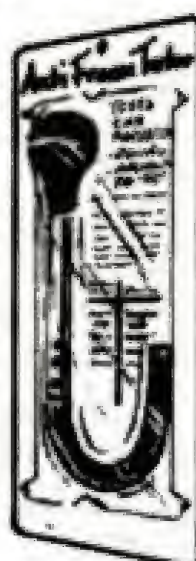
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DRIVIN' WITH DAN

(Continued from page 22)

mum fuel capacity. Indy has both. Can-Am cars are two-seaters; Indy cars, one-seaters. Wheel sizes are restricted at Indy, but not in Can-Am.

Q. What is the top speed of a Ford Mach 1 powered by a ram-air 428?—Jim Applegate, Queen City, Mo.

A. I would guess that most of them can go over 125 mph just about anytime. Some might go over 150 mph, a few top 170. With a lot of work, one could probably top 200. The supercharged drag versions can do over 200 mph in a standing quarter mile. In other words, it depends.

Q. Why isn't Ford, which seems to think so much of racing as a sales tool, any more effective in Can-Am racing? I don't see how it can afford to take such a beating from Chevrolet in a major series.—Robert J. Beckwith, Houston.

A. Ford doesn't build and sell a suitable engine at the moment. Chevrolet has an aluminum 427 which is the basic ingredient for all the winning Can-Am engines this year. Chevy isn't in stock-car racing, but Ford is. Chevy apparently prefers to spend money making parts readily available to customers who want to go racing on their own.

Q. I'm told that Ford's three-speed automatic is better for high-performance cars than the four-speed synchromesh because the gears shift faster. I don't agree. What do you think?—Arnold Schmidt, Jr., Raleigh, N.C.

A. I don't agree either, but they are mighty good, and also very close on performance. I drive an automatic mostly, but for road racing, I believe the old four-speed is still best.

Q. When we refused to buy our 16-year-old son a motorcycle for street use, he suggested that we write you for your opinion. He says he thinks they're safer than a car; we are frankly scared of them. What do you think?—Mrs. L.L. Benfield, Norfolk, Va.

A. In the first place, I must warn you by telling you I love motorcycles. If your son

(Please turn to page 38)

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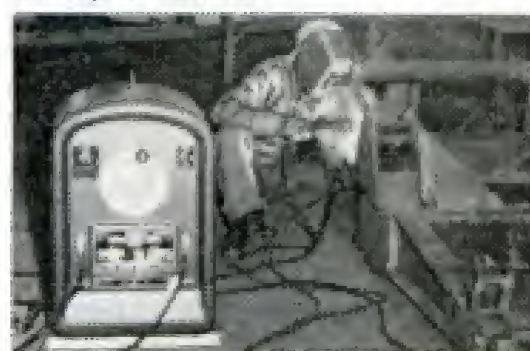
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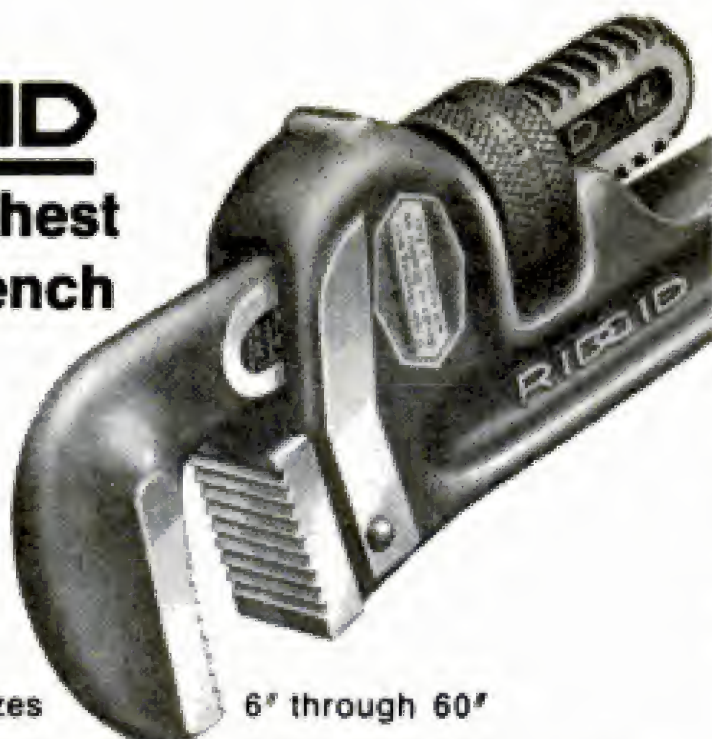
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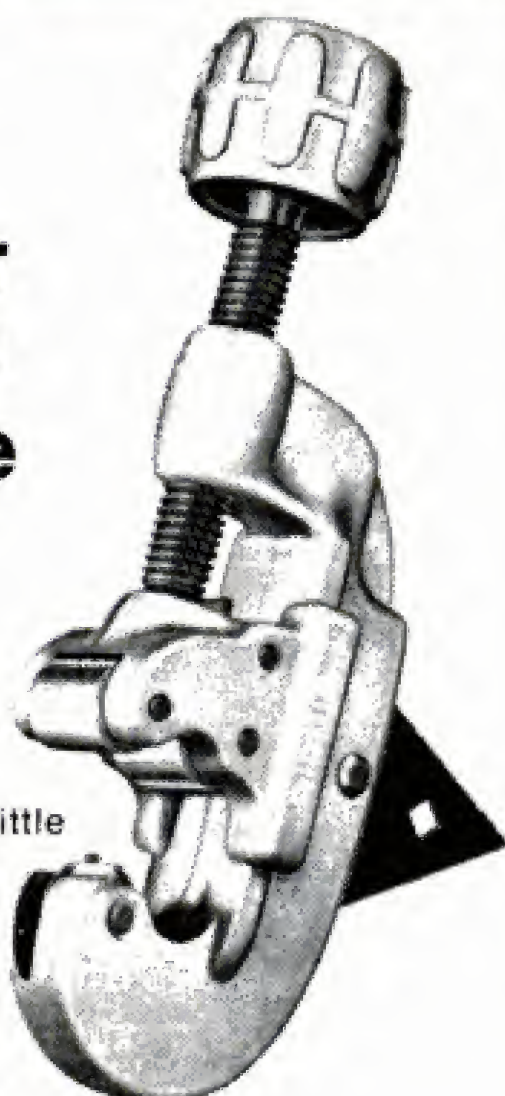
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DRIVIN' WITH DAN

(Continued from page 37)

has excellent judgment and thinks defensively all the time, I think he should be allowed to own one. I don't think they are safer than cars. But on the other hand, they need not be more dangerous. I feel that a machine, whether it is a car or a motorcycle, does what the driver or rider makes it do. How good is your son's judgment and ability? If you can rely on your son in this respect, I believe you can rely on a motorcycle.

Q. I'm not interested in precise figures, but wonder by how much airconditioning reduces the efficiency of a car's engine. What is your opinion?—Dr. H.K. Summerville, Houston.

A. If you're going along at a steady neutral throttle, and switch on the airconditioning, you can feel the slow-down. My guess would be that it knocks three to five percent off acceleration and mileage.

Q. How does Ford's new small block compare with your Gurney-Eagle version of this engine? And do you expect more Ford engines in Formula A racing next year?—Tim Anderson, Browns Mills, N.J.

A. I am prejudiced, of course, but I feel that it is not as good. However, it is less expensive. I do expect more F-A Fords in racing next year. The 305-CID Trans-Am Mustang Ford engines are pulling more than 500 hp now.

Q. Could I step out of a pro race-driving school into professional competition? Do you think I could support myself or should I keep a job?—Judd Cadwell, Grand Rapids, Mich.

A. It really depends how good you are. It could be done, but you would probably be the first man to do it if you did succeed. I suggest you keep a job until you get a good idea of how you stack up against competition. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 92B).

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BY DAN FALES

SNOW POLO is the newest of the active snowmobile games. It's played with three machines to a side, and one person to a machine. A shortened polo mallet is used to hit a leather or hard-rubber ball with a circumference of 14 to 16 inches.

There are four 15-minute quarters in the game with 10-minute breaks after the first and third periods, and a 20-minute intermission at half time.

Snow polo is played on a rather large field—300 yards long by 165 yards wide. The goal posts—usually 55-gallon drums set 20 feet apart—are located at each end.

To hit the ball, each player must use only the mallet and must be on his machine. Several right-of-way rules are observed to eliminate collisions at times when a number of snowmobiles are chasing the ball.

As in regular polo, it's the maneuverability of your "mount," not its speed, that counts. This means that the high-powered snowmobiles are not good for this game. Most of the players feel that machines



having 300 to 350-cc engines are tops.

If you're interested in the rules, send 75 cents to Thomas Lynch, 1000 Oak Brook Road, Oak Brook, Ill. 60521, for his *Sno-Polo Guide*. Lynch also has information on obtaining mallets and other materials for playing the game.

Snow-polo teams have popped up in more than a dozen cities and towns across the country. And, there's even an unofficial national championship which is held every year at the Chanticleer Inn in Eagle River, Wis. ★★★

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POPULAR MECHANICS



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DETROIT LISTENING POST

BY BILL KILPATRICK

THE REAL EYE-POPPERS from General Motors in '71 will probably be Buick's Riviera, Oldsmobile's Toronado, Cadillac's Eldorado, all three even now not exactly exercises in modesty and restraint. As now, all will be built around the same body shell, but will be even more distinctive. One source told us the cars will have a decidedly European GT flavor, the accents being definitely Italian. If—hopefully—the cars duplicate (or even attempt) Italian GT handling and braking, GM could find itself in a whole new world.

ALL STOPS ARE OUT AT FORD to make its forthcoming small car—to date called Phoenix—a VW-beater in every respect. The car, which might debut as early as next spring, has as its goal outstripping "The Bug" on looks (*that* shouldn't be too hard), power, economy, handling, ease of service. Particular emphasis is being given to the latter. Right now the ubiquitous Bug is the closest thing the auto world has to Henry's marvelous T, meaning parts and VW-tailored gadgets are readily available, that an owner needn't be more than average brave to risk doing his own repair work. So, to beat VW at what has become its own game, the word at Ford is to make the Phoenix "the most serviceable car ever built." Considering Model T history, that's a real order.

IF YOU OWN a Camaro or Firebird convertible, hold onto it, it may be the last of the breed. Same if you own a notchback. Talk around town has it that when all-new versions of the two cars bow after the first of the year (February's a good bet) they'll be offered as fastbacks, period. Decision to make the cars available in only one body style may portend the rumored and long-awaited (at least by dealers) cutback by manufacturers in model proliferation. The same sort of reasoning is said to be in vogue at Ford regarding the radically restyled Mustang now in the works.

FUEL ADDITIVES, denounced by some as one of the great put-ons of our time, may provide at least one way to go in the battle against car-caused air pollution. A Long Beach, Calif., outfit—AnPol Chemical Corp.—has come up with an additive which it claims will reduce harmful exhaust emissions as much as 50 percent. If true, a lot of auto-industry headaches will be at least partially relieved; right now, the clean-air problem has Detroit working feverishly to further improve on the solutions (e.g., PCV, evaporative control systems) it has already evolved. An effective additive would make the job just that much easier. AnPol said its "wonder drug," called (appropriately) *AnPol*, not only reduces emissions, but also boosts horsepower. West Coast engine whiz Bill Stroppe, no stranger on auto-racing circuits, is reported so impressed with the stuff he's working out a deal with the manufacturers to peddle it through speed shops under the label FAST. Tests of the additive on Stroppe's dynamometer reportedly indicated hp boosts of as much as 20 percent. All this and cleaner air, too!

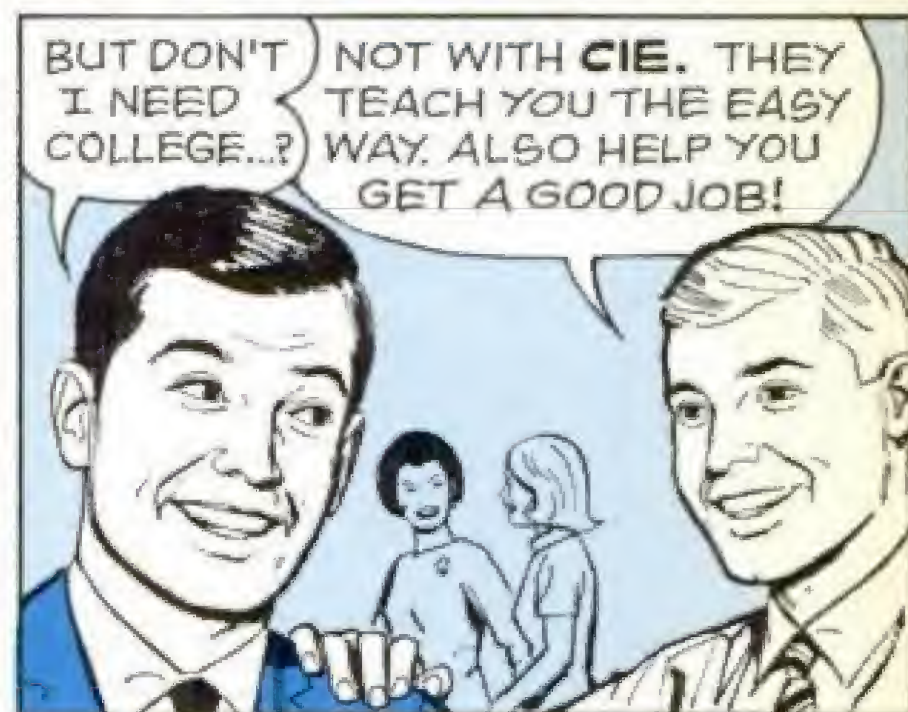
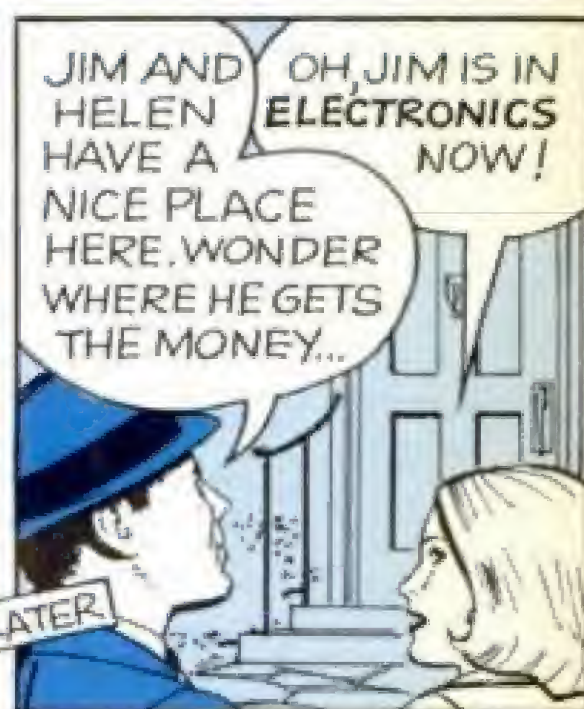
AN INFLATABLE JACK will hit the market later this year. Developed by B. F. Goodrich, the rubber jack looks like a king-sized hockey puck when deflated, a small keg when blown up via a pressure bottle containing either compressed air or gas. Reusable, the jack will lift a tire three inches off a level surface, can be inflated in less than a minute. Jack is one piece, weighs only 2½ pounds, measures 3 inches thick, 13 in diameter when deflated, 21 high, 8½ wide at the top, 9½ at the bottom when blown up. Goodrich says the jack will take pressures up to 70 lbs. p.s.i., will safely lift any car. Automakers are said to be interested in the jack as possible OE.

AMERICAN MOTORS will field yet another Hornet next year. The car will not be

(Please turn to page 47)

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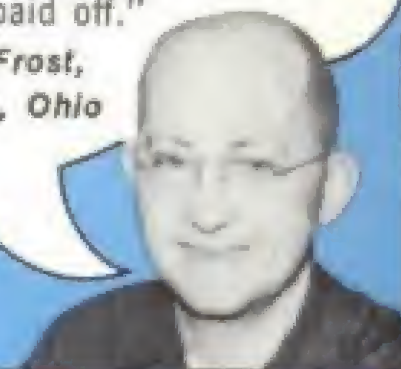
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DETROIT LISTENING POST

(continued from page 44)

tabbed a '71, but rather another version of the recently-introduced 1970 Hornet. The new one will be more stark than the present Hornet, will not carry a V8 option, will sell in the \$1800 range. Look for it in late February, early March. About this time—or a little later—look for an all-new small car (no name yet) from AMC.

ON THE MARKET along about now should be a new version of duPont's Zerex antifreeze. Key to the new brew is the presence of polystyrene balls ranging in size from one micron to 500 microns, their purpose being to pack together and plug small cooling-system leaks such as solder seam cracks, gasket leaks, the slow-drip-drip leaks that tend to open around hose clamps. The material won't plug big hose breaks or breakdowns of or in cooling system components (the water pump, for example). In normal operation, the polystyrene balls float along in the regular ethylene glycol antifreeze solution, accumulate and pack together only in the event of a leak.

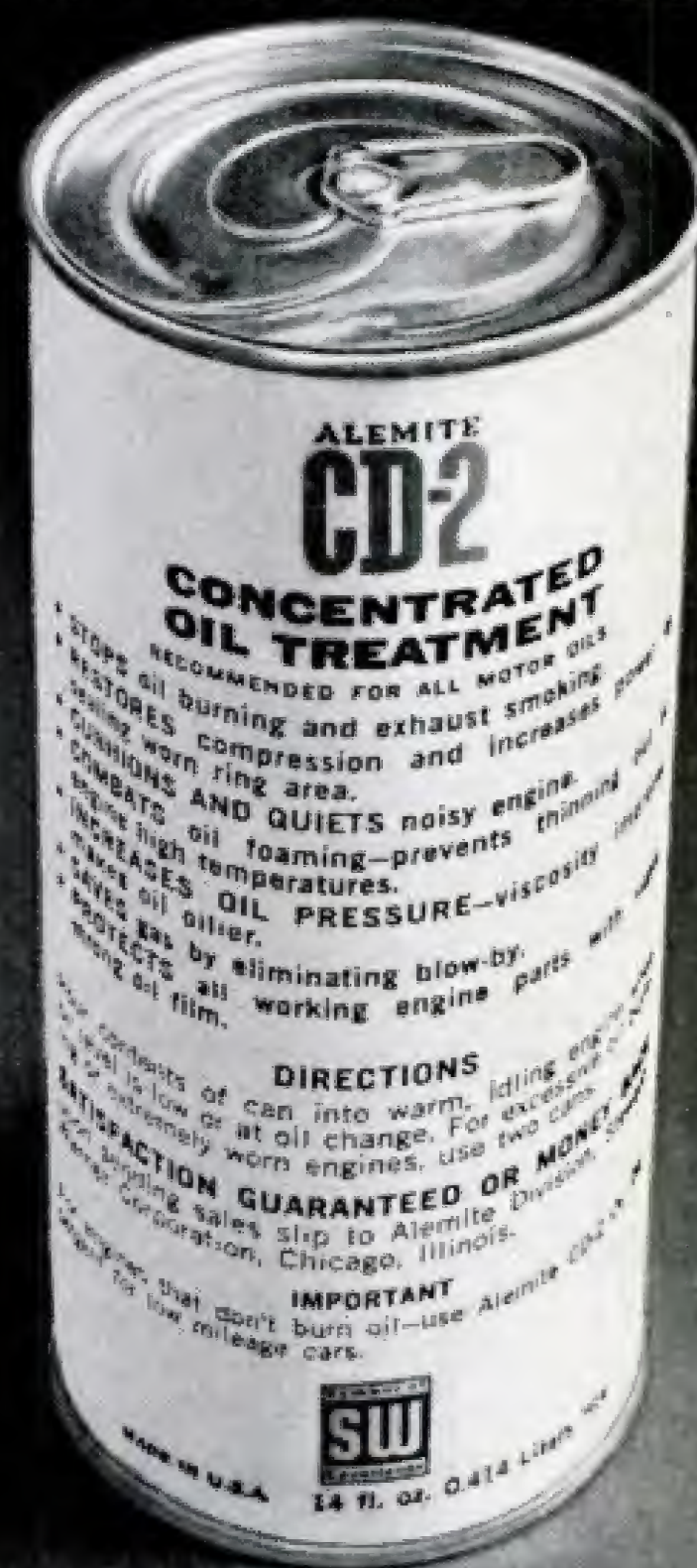
MICHELIN, French tire manufacturer, will build two new plants in Nova Scotia, the company's first manufacturing venture in North America. Plants will be located near Bridgewater and in Pictou County, will represent an investment of \$75-\$100 million when completed next spring. Tires made in the new plants will be sold mainly in Canada and the U.S., but will also be exported throughout the world.

NOSES LIKE SHIP PROWS are on the way out in industry styling studios, partly through a need for a fresh look, partly to get the safety people off the industry's back. The projecting grille will still be around for a few years, but the protruding center section will be curved (Pontiac's Grand Prix, for example) rather than pointed. Safety people, who've scorned sharp snouts for years, apparently can get results if they holler long and loud enough.

BRITISH AUSTIN reports its Austin America, an economy import designed as a so-called "second car" for the U.S. market, broke all Austin sales records for this country in its first full year over here. Austin sold 16,628 units as opposed to the 11,811 record chalked up by the old Austin Devon in its peak year of 1948. The America offers either a manual or automatic transmission and sells both versions for under \$2000. ★ ★ ★

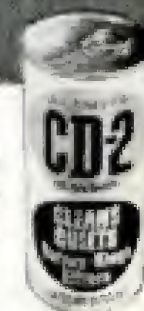
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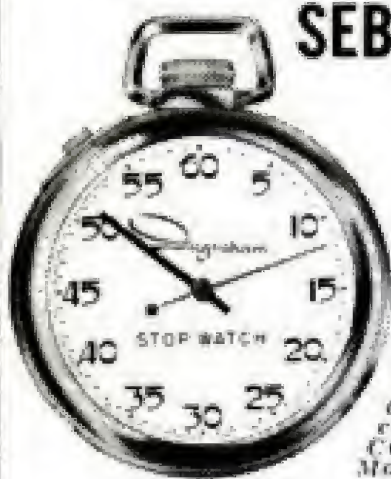
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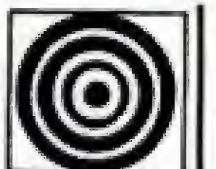


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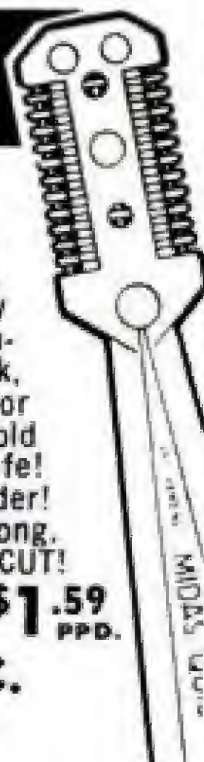
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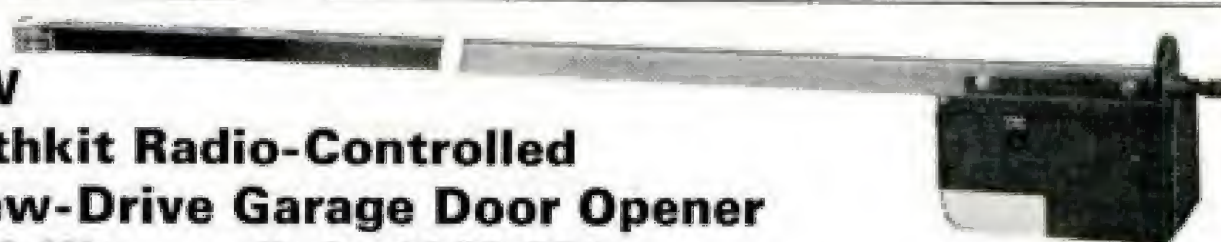


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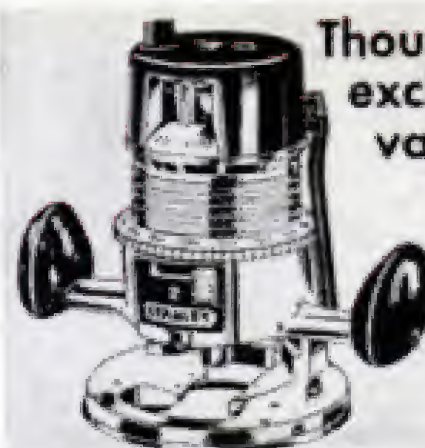


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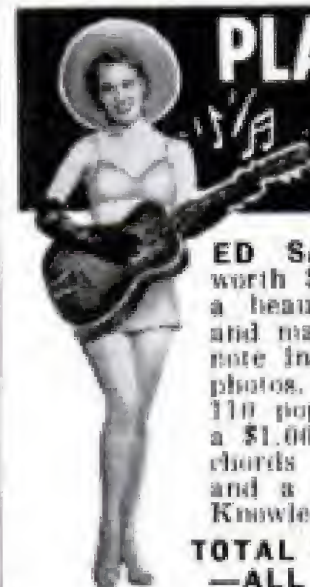
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Boston: Nature Food Centres
Cambridge: Nature Food Centres
Springfield: General Nutrition Ctr.
Worcester: Nature Food Centres

MICHIGAN
Battle Creek: The Health Food Center
Detroit: Detroit Vital Foods
Lansing: Randall Health Foods

MINNESOTA
Minneapolis: Health Harmony, Inc.

MISSOURI
Clayton: Clayton Natural Foods
Kansas City: Nature Food Centres

NEW JERSEY
Atlantic City: Artman's Health Foods
Bergenfield: The Health Shoppe
Cherry Hill: General Nutrition Centers
Edison: Health House
Jersey City: Advanced Health Foods
Morristown: General Nutrition Ctr.
Newark: Zinn's Health Food Store
Summit: Summit Health Food Centre
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NEW YORK
Albany: Nature Food Centres
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East Syracuse: Diet & Health Shoppe
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Cincinnati: Spatz Health Foods
Dayton: General Nutrition Centers
Cleveland: General Nutrition Centers
Toledo: Dietrich's Health Foods
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OKLAHOMA
Oklahoma City: Nutritional Food Center
Tulsa: A Nutritional Food Center

PENNSYLVANIA
Allentown: General Nutrition Centers
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ON-THE-GO

CAMPING

BY WADE MITCHELL

SECRETLY A NEW MOTOR HOME is being prepared by Grumman Allied Industries—masters of riveted aluminum air-frame construction. Speculative reports indicate that their contribution will be a luxury item. Insiders claim that Grumman's vast aircraft and boat-building experience will give them a great advantage in the motor coach field, but only time will tell.

MORE WARRANTY PROTECTION FOR RV BUYERS. A new interpretation from the Federal Trade Commission indicates that verbal assurances from a salesman may be construed in courts of law to represent a guarantee. If a salesman describes an RV as being good for a certain purpose, he is, in effect, warranting it for that purpose, according to the new definition. Carry a notebook with you when you shop for a new trailer, camper or motor home. Jot down any unusual claims that the dealer or his salesman makes for a product. Before signing the contract of sale, show your notes to the dealer and ask him if he agrees with his salesman's comments. You'll either get a fast approval or an embarrassed apology. Either way, it's bound to be interesting!

WORLD'S FIRST SPLIT-LEVEL CAMPING VEHICLE! Link-up coaches are on the way! Advanced design privately shown to *PM* functions like this:

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3. Difference in floor height between coaches is handled with fold-up step in trailer.

FACING SOME REPAIRS? Make sure you get several estimates. There is no standard pricing in the coach-repair business. One shop might quote \$375 to repair a crushed three-way corner, while another would do the same job for \$250 or less. Repairs involving more than one panel cost the most, such as damage to intersecting sidewalls, sidewall-to-roof, or roof-to-front wall. Because of the ultraspecialized nature of coach repairs, the state of the art is roughly comparable to the television industry in 1950: too new to set price standards.

NO-SLIP DIFFERENTIAL CONTINUES TO DRIVE WITH BROKEN AXLE. They call it the Hy-Torq model, and the maker claims that even with one axle broken or removed, it continues to deliver power to the other wheel. No spider gears, cams or friction clutches are used. The Hy-Torq unit employs rollers to differentiate the axles. This new model is made by Hy-Torq Corp., 8609 S.W. Barbur Blvd., Portland, Ore. 97219.

DON'T FILL WATER TANKS FROM STRANGE HOSES! Many campers have cut short vacations because of nausea, cramps or fever. Eliminate this potential problem with any one of three easy solutions: First, fill tanks *only* from known sources of fresh water. Second, carry bottled water for drinking purposes where water is suspect. Third, install a quality water purifier in your coach. Prices range from a few dollars to about \$100 for a top-brand water purifier of generous capacity. That's a lot less expensive than a ruined vacation, medical bills, and discomfort.

NEXT YEAR'S TRAVEL TRAILERS WILL COST ROUGHLY \$250 MORE per unit, says one manufacturer. Greater labor and material costs and increased taxation account for most of the price rise. If you're considering the purchase of a luxury trailer, you'd better hurry. Within a few months, prices will be upped. ★★★

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New barrier near Frankfurt

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It's a tree, he says

Flowers and bushes he had—but no trees. So London sculptor Robert Simon created a 20-foot "tree" of galvanized gray metal, plastic, wire and a bright red bowl. However, a number of Simon's neighbors objected that it wasn't a tree at all, but an eyesore. Beautiful or not, Simon says the metal tree gives him superb television reception.



Early warning for flat tires

A tiny radio transmitter that fits on the valve of a car tire (top photo) is activated if tire pressure drops. It sets off a warning light on a receiver (bottom photo) in front of the driver. The experimental system is a British development.



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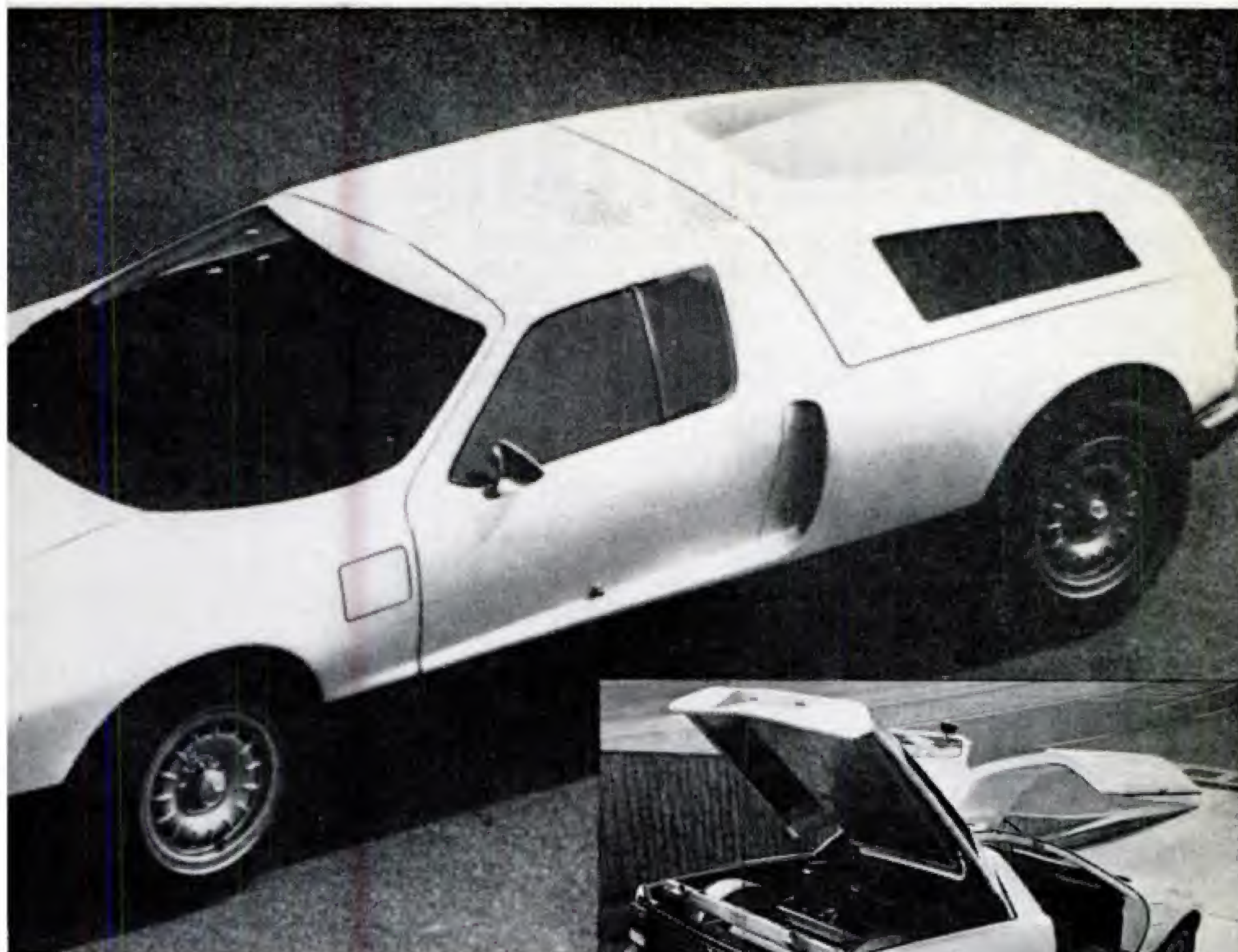


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BY MORT SCHULTZ

Cougar cuts out

My 1968 Cougar acts like a cold fish in the morning. The engine cuts out and has to be re cranked three or four times before it finally takes hold. Then it runs like a tiger the rest of the day. What's the remedy for this morning sickness?—Alfred Greer, San Antonio, Tex.

Give it the automatic-choke, fast-idle treatment. Make sure the choke's closing fully for the start—it could be out of adjustment or have a bad part, such as a weak thermostatic spring. Then make sure the fast-idle cam is set properly to provide the fast-idle speed needed for morning get-up-and-go.

The ultimate test

If you can solve this one, you're a genius. No one else can and they've driven the car—a 1967 Plymouth Fury III. When I drive along with my foot on the gas pedal, everything's fine. However, the minute I release my foot from that pedal, there's a terrible rumbling sound from beneath the car. It's been like this for 21,000 miles, and every Plymouth mechanic who's tried his hand at stopping the racket has failed. Good luck.—Charles P. Reichardt, Mays Landing, N.J.

There are a few things that can cause this, Charlie, such as a loose baffle in the muffler that's sounding off on deceleration. When you decelerate, a vacuum is created inside the muffler which could be rocking the baffle. Have someone get his ear close to the muffler as you accelerate and decelerate. Other conditions that can create a rumble include exhaust-pipe interference on deceleration, a loose engine-mounting bracket, and faulty drive-line angularity. A sharp mechanic would run the car on a dynamometer to duplicate the condition.

Obstreperous speedometer

Do you know why the speedometer of my 1968 Chevy II Nova should make noise? My dealer has replaced the cable with a new one.—Miss Marie Pannone, North Haven, Conn.

I know of nine reasons why a speedom-

eter can make noise, so replacing the cable isn't always the answer. Here they are as outlined for Chevy shops (remind your dealer) in the Chevrolet Service News for Nov., 1968: (1) loose cable coupling nut at the speedometer head; (2) tip of cable is bent at the speedometer head; (3) cable extends too far into the transmission; (4) there's an extra or a missing thrust washer on the cable at the speedometer head; (5) speedometer cable and/or the casing is kinked; (6) cable isn't properly lubricated; (7) maybe the noise isn't in the speedometer system at all—perhaps the driven or drive gears at the transmission are at fault; (8) speedometer cable is whipping; (9) a bad speedometer head.

Baby talk

A couple of months ago I drove my 1962 200B Mercedes-Benz to the point of seizure because of a leaky radiator hose. The head was pulled and milled to the maximum of 20 thousandths, valves were replaced, and the head was reinstalled using two gaskets. Now I'm getting water in a cylinder. A friend says to pour evaporated milk into the cooling system—that it will cure the problem. Will it?—Harry E. Dieckman, Harvey, La.

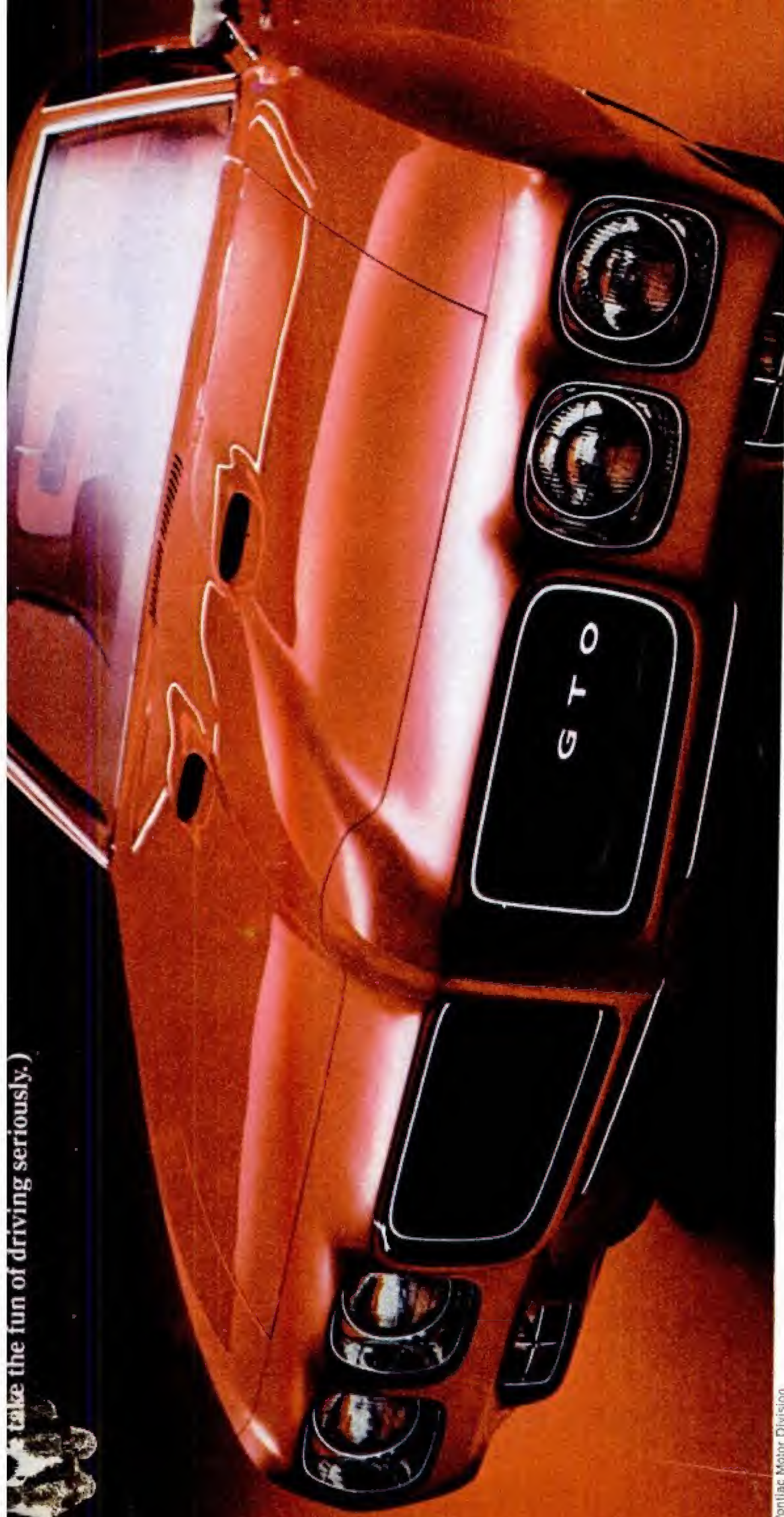
No, it won't. You'd better replace that aluminum head, which probably warped badly because of your unfortunate experience. It will pay to look around for a used one, because a new head costs about \$160. Try some agencies that sell foreign cars. Occasionally, they take in badly beat-up cars which they can't restore, but can cannibalize for parts.

Tired Tempest

My 1966 Pontiac Tempest V8, demonstrates a perceptible lag on acceleration, causing the engine to die out on occasion. This happens after a stop or when rounding a slow corner. A "cold stumble" kit was put in. It hasn't helped. Neither have endless carburetor adjustments.—Byron Mackay, San Antonio, Tex.

It's possible that the kit put in your car was kept in storage for some time. This delay will cause the neoprene cup of the accelerator pump to become hard, affect

take the fun of driving seriously.)



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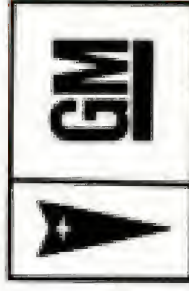
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About now, a lot of pseudo performers are wishing they could slither off to a nice, quiet garage.



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ing its performance on acceleration. I'd replace the pump with a new one. If that doesn't work, look for the cause of the problem in the ignition system, such as faulty timing or distributor-point dwell.

Bouncy brakes

I have a 1965 Mercury. When I apply the brakes, the foot pedal jumps up and down. I've had it to a brake repair shop, but it still does the same thing. The repair man told me to get rid of the car. What should I do?—James D. Maxwell, Yates City, Ill.

Keep the car—get rid of the repair man. It sounds like a drum (or drums) out of round. Maybe it can be machined—maybe not. But it's a lot cheaper buying new drums than a new car.

Bum steer

I hear and feel a "groaning" vibration when I turn the steering wheel of my 1969 Buick LeSabre with power. It occurs especially at slow speed, and I can't detect it when going over 35 mph. The service manager tells me it's a normal thing. Do you agree?—Ralph H. Caldwell, Greensboro, N.C.

I wouldn't regard this as a normal condition until I replaced the drive belt and power-steering valve on the chance that they were bad.

Stopping a leak

The car is a 1967 Chrysler Newport Custom. The problem: I've gone through three power-steering hoses in the last two years. They all start to spout at the metal connection halfway up the hose. Can you put a finger in this dike?—L.V. Laurie, Woodland Hills, Calif.

Try this. If your car is equipped with airconditioning, are you using a Hypalon power-steering pressure hose (part No. 2537613)? The standard neoprene hose (part No. 2537612) won't withstand the higher temperature of the power-steering fluid on an airconditioner-equipped car.

Hot stalling

I have a 1964 Corvair that runs smooth-

ly while the engine's cold but stalls at every stop I make when the engine is warm. Mechanics who tune it up swear my trouble is over. Not yet it isn't. Can you help?—Noble St. Clair, Ann Arbor, Mich.

There are several reasons why a car stalls when it's hot and not when cold or warming up. First, carburetor idle speed may be out of adjustment, causing an improper or unbalanced fuel-air mixture. Perhaps the engine is flooding at hot idle because of a high carburetor float level, a leaky carburetor needle and seat, or excessive fuel-pump pressure. Maybe the choke plate is sticking in a partially closed position. Also check for a dirty carburetor air-cleaner filter that can give the same effect as a partially closed choke. Maybe heat is causing a mild vapor lock condition. These are things to look into that a mechanic who simply does a tune-up won't consider.

Service Tips

● **1968 and 1969 Plymouths, Chryslers, Imperials and Dodges** with 383 and 440 cu.-in. engines and 4-barrel Holley carburetors have been failing to start when the engine's cold. Why? Blame a sticking choke. Chrysler-Plymouth service bulletin 69-14-2 (1/22/69) and Dodge service bulletin D69-14-2 (2/12/69) tells your dealer how to fix it. Briefly, the solution calls for filing a bevel on the rear side of the raised lip on the choke-coil cover.

● **Chevrolet's 1969 Corvette** with 427 cu.-in. engine and power steering should sport a new upper radiator hose if the one you now have on the car is rubbing against the Delcotron pulley. The new hose (part No. 3967433) provides adequate clearance. Until you can get it, make sure the hose now on the car is positioned so it doesn't interfere with that pulley.

● **1969 Fords and Mercurys** with rim-blow horn systems may experience no blow in cold weather. Plastic at the horn terminal connection shrinks, creating poor electrical contact and erratic horn operation. Your dealer should remove the steering-wheel crash pad, torque the three horn-terminal screws to assure a tight contact and reinstall the crash pad. ★★ ★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.

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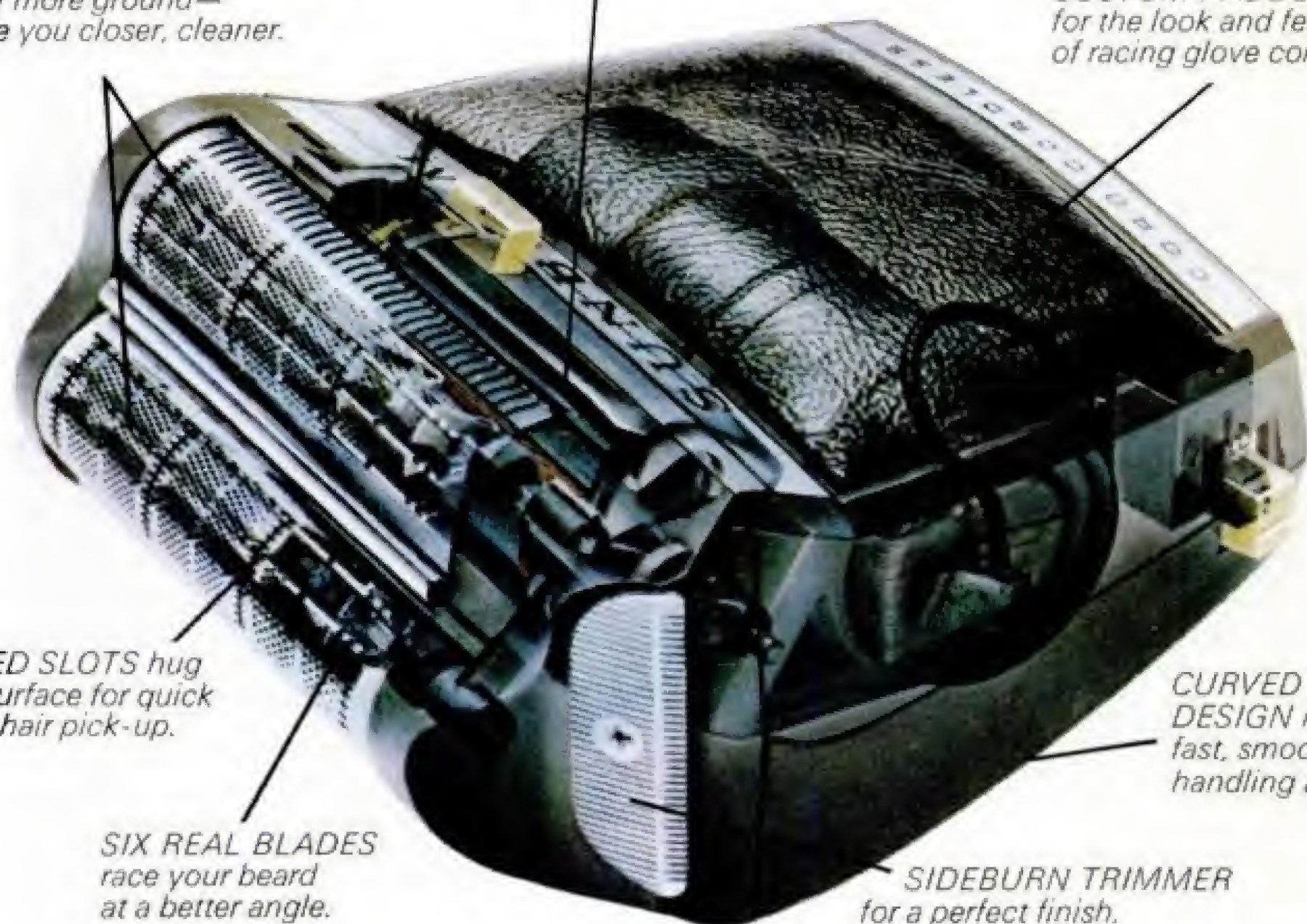
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

In-and-out home repairs

By necessity I must become a lady "handyman" and I need some elementary "how-tos," such as patching small cracks in walls and ceilings—what patcher to use and what kind of paint? Outside trim needs painting; what kind of paint do I use? Heating is a forced warm-air system; how often should filters be changed? There are small leaks in basement walls; how do I patch them? Screens have some whitish spots; how can these be removed? With kerosene?—A.V., Ind.

Small cracks in plastered walls and ceilings are usually filled with spackling compound, applied with a wide putty knife and sanded smooth after it dries.

Use a water-soluble interior paint on walls and ceilings; color, your choice. Apply it with a roller a narrow strip at a time and usually across the width—so that you can roll to a wet edge when rolling on the second strip.

On outdoor trim, brush or scrape off all loose material and "feather" the edges of blisters flush so that they will not show under new paint. Use a paint especially compounded for outside trim. If "trim" includes sash frames, be careful not to "paint them in." After painting loosen each sash to break the seal. Be sure to lower the upper sash and raise the lower one so you can paint the exposed outer edge of the upper rail of the latter. Do this work only during the warmer months.

Hold an unused furnace filter up to good light and note its clarity; when this "see-through" has been reduced 50 percent, or less, used filters should be replaced.

As a rule, small cracks in basement walls can be filled with a masonry water-proof paint. Apply paint to cracks first; then do the whole wall.

Whitish spots that usually appear on aluminum screening can be removed with a detergent. Don't use kerosene; it's a fire hazard.

Replace wooden gutters?

My old house has wooden gutters. Although they still don't leak they are "un-modern" and unsightly. What kind of guttering should I use as a replacement—aluminum, steel or plastic?—S.L., Mass.

If the wooden gutters still "turn water" why replace them? Why not just freshen them with a new coat of paint or two and let well enough alone? But if replacement is a must, you have a wide choice of types and materials. If I had to do the job myself I'd select ordinary aluminum guttering with those handy slip-connectors. Such an installation can be a fairly neat job if done with care, and is likely to be the cheapest of all. But if I were to contract the work I think I would order galvanized-steel guttering. It's neat and durable if the work is done properly. Pre-finished metal and plastic guttering also are widely used. You have no painting problems with these types, but such installations are relatively expensive.

Finishing 'raw-wood' turnings

I obtained four cherrywood squares from a sawmill, dried them in my attic for two years and then turned them into "cannonball" bedposts. Rather huge cracks have appeared in all four turnings. What can I do now to salvage them?—W.T., Ky.

Well, you've learned that the attic is no place to cure "green" wood. It can be done, of course, but not in the average attic. Salvage? Other cracks could turn up as the seasoning process continues and those existing may widen. Then again, maybe not. I'd fill the cracks with wood putty colored to match the wood as nearly as possible. Then, when I was sure the putty was thoroughly dry, I would remount in the lathe and cut down the turned parts very slightly, and sand them until the patches were as smooth as the wood, or as nearly so as possible.

For a finish, I would use artist's color direct from the tube, rubbing it on with a finger. In this way you can control the color and conceal the patchings. After this "stain" dries at least a week, cover it with a semigloss clear lacquer or other clear finish. Rub the final coat with fine steel wool. While new cracks may appear, the chances are this treatment will work.

Wintering roses

Do those big plastic cones give adequate winter protection to rose plants? If so, how are they placed and anchored?—Y.L., S.D.

Yes, if you don't remove the protectors until all danger of frost has ended. You simply slip the cones carefully over the plants and anchor with stones, bricks, or other weighting material such as earth or short length of heavy planking. ★★



7:22. Good morning.

Your eggs are getting cold.

If it says 7:22, believe it. Because it's a **Waltham**. With a Swiss movement. The **Auto-Cal Courier**. Thoroughly male. Designed to get you through the day on time. Even if you're off to a late start right now.

Notice the calendar? Now you know what day it is. That's a significant start, Sleepyhead.

Consider: self-winding. Luminous hands. Luminous hour dots. Wow, that moon is bright! Sweep second. And a heavy, no-nonsense expansion band.

It won't wreck your budget, either. You can pick it up tonight, after work.

Don't gulp.

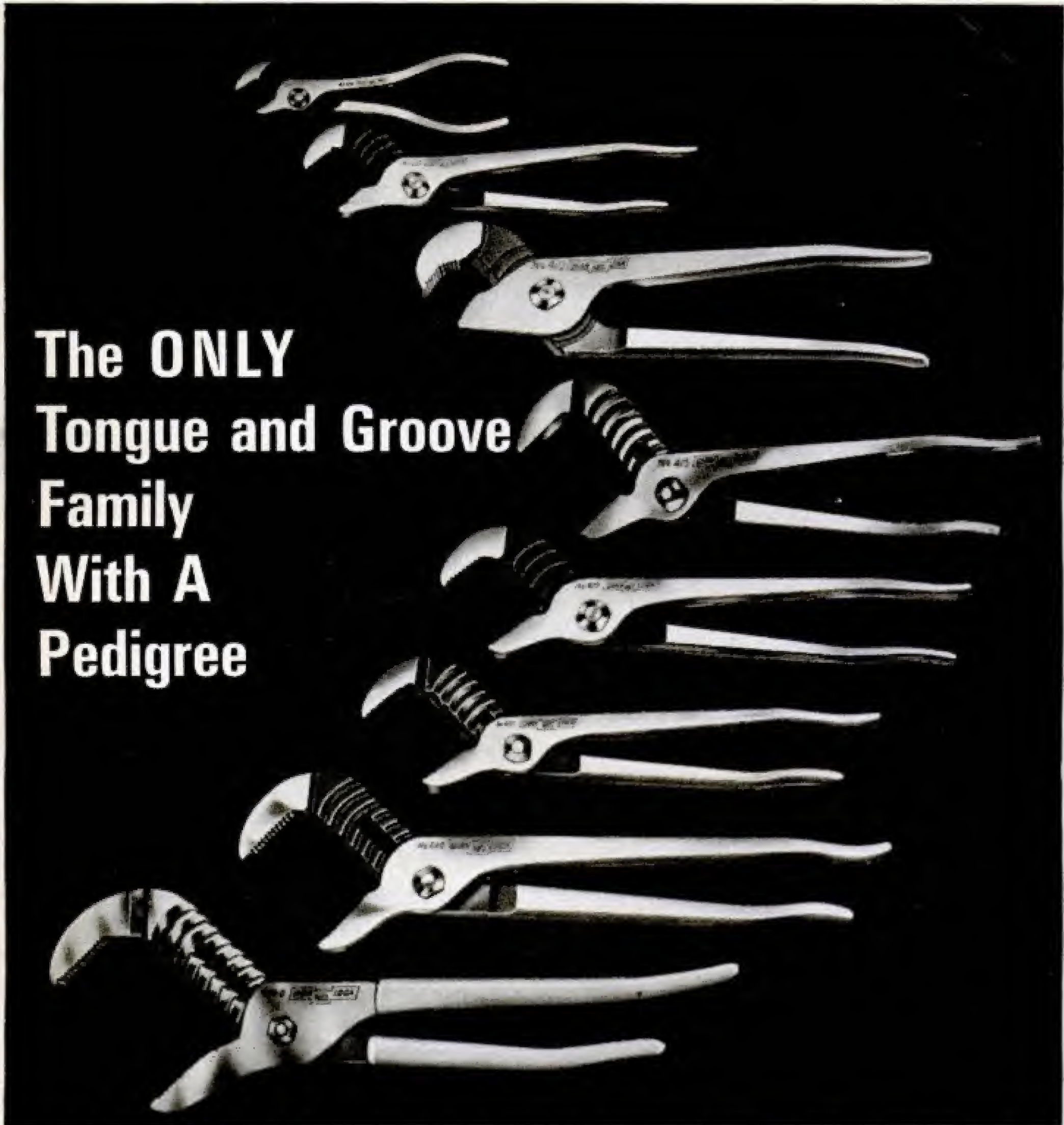
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A Volkswagen dealer will gladly sell you one.

Obviously.

What's not so obvious, however, is why you would gladly buy one.

So we'll give you a little clue:

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A 100% guarantee.*

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The VW dealer guarantees 100% to repair or replace it. And it doesn't cost you a cent.

Not every car he gets in trade gets that guarantee, either. Only those that pass a tough 16-point inspection earn his guarantee sign.

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*The dealer guarantees 100% to repair or replace the engine, transmission, rear axle, front axle assemblies, brake system and electrical system, for 30 days or 1000 miles, whichever comes first.

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RIVIERA™ NUTMEG ELM



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Ready for the road

The foam-padded headrest, padded guard rail around the middle and nylon mesh restraint vest of the Strolee "Safety Cradle" keep this lad safely packaged for car travel.



One man, two jets

Sud Aviation has started testing a one-man, jet-powered "helicopter" that will be used by the French army. First flight of the Ludion took place at a test center near Paris.

OCTOBER 1969

free

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good conversation, and best of all, the best of all,
Miller High Life. For over six generations,
the great premium beer.

Miller makes it right!



Next Month in Popular Mechanics

How We Built a House for \$7500

A 29-foot living room with fireplace and glass doors to the patio; three bedrooms, two complete baths, 90 square feet of closet space and airconditioning—how do you get all that for \$7500 today? You build it yourself. The Robert Hunt family of Cicero, Ind., did—and they have the receipts to prove that you can do it, too.

How to Catch a Hippopotamus

. . . or an elephant or a zebra or a buffalo. Game wardens in South Africa's Kruger National Park do it every day. All you need is a helicopter or a bulldozer, a crossbow, a quiver of tranquilizing darts and a steady aim. It also helps to take a tranquilizer yourself.

Build a Christmas Greeting for Your Lawn

Designed especially for *PM* readers, this Christmas greeter is motorized and decorated with Disney characters. Complete plans, including Project-a-Plan slides (which make it a snap to copy the art), are in the November issue.

Oceangoing Drive-In

There's a new type of cargo vessel—the roll on/roll off container ship—that handles almost anything that can be pushed, pulled or driven aboard. The odd-shaped and oversized cargo that won't fit in containers (buses, bulldozers, steamshovels and the like) is rolled aboard over stern ramps while overhead cranes load the container cargo.

Jetting Down Montana's Mighty Missouri

Shallows, rapids and steamboats were all part of *PM*'s test of Glastron's new 17-foot Berkeley jet boat.

Bring Life to Those Forgotten Snapshots: Make a Montage

Mounting a whole collection of prints on a background panel is a handsome way to display photos that usually get stored away in a bureau drawer.

Tune In Shortwave on That Transistor Portable

This handy, home-built antenna selector can pull in shortwave on a small transistor portable as well as improve reception on expensive multiband receivers. It also lets you control a tape recorder and external speaker.



Come ride

Scorpion '70

... the snomobile that tops 'em all for family fun, personal enjoyment



Take your family where the fun is...

... travel comfortably, dependably, safely on Scorpion '70 to the thousands of beautiful sights and fun-filled moments awaiting you over each new hill, in each new valley. Cruise leisurely, with unmatched stability...

or light the fuse and...

And how! Sleek new Scorpion '70 bombshells are loaded! Light the fuse under one and see for yourself. Scorpion's range of power plant options will rocket you as fast and as far as you want to go!

Tame or wild...

... it's your choice with Scorpion '70! Five great models to choose—with engine options up to 800cc's. And remember, Scorpion snomobiling is 24-hour-a-day fun. Scorpion's one snomobile that's not afraid of the dark. Because when day is done, Scorpion isn't. It's ready to take you there and back in grand style. So shoot the works! See your Scorpion dealer now and make the scene with Scorpion '70.

The proven snomobile that never lets you down—

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... FIREWORKS!



Amazing New Instantaneous Fire Extinguisher

**Popular
Mechanics**

By ARTHUR FREESE

An electronic device that can put out a fire faster than you can blink an eye now saves racing drivers from their most dreaded enemy. You could have one, too, in your family car or boat



A NEW FIRE-EXTINGUISHING SYSTEM works so fast that you can soak a \$100 bill in gasoline, hold a match to it, and see the flame go out before the paper is even scorched. This recently developed solid state optical detection system can put out a fire in 50 milliseconds—50 thousandths of a second—about one-thirtieth the time it takes to blink an eye.

The system protects racing drivers (Bruce McLaren, Bobby Unser, Sam Posey, Joe Bonnier, Ronnie Bucknum, Denny Hulme, Tony DeLorenzo, Tony Adamowicz, among others) by automatically detecting flame and releasing in the cockpit a nontoxic gas that immediately breaks the chain reaction needed for combustion. The system is also used for military helicopters and planes, computers and bank vaults, radioactive "glove boxes," and on one of our new aircraft carriers. The new extinguisher protects many private pleasure boats, and recent tests indicate the system will soon protect our troops in Vietnam as well.

This fire detector and extinguisher uses an optical infrared-sensing device and Freon gas. (Freon is DuPont's brand name; there are others.) Discovered in the late 1930s, this colorless, odorless gas, a member of the fluorocarbon family, was soon used as a refrigerant because its nontoxicity and nonflammability are truly amazing. Freon 1301 (or Halon 1301, the generic name) is able to put out all common types of fires. The infrequent fires for which this gas can't be used are those involving chemicals such as cellulose nitrate that contain their own oxygen supply; reactive metals, such as sodium or magnesium; and the metal hydrides.

Where the conventional extinguishing agents take considerable time to kill a



FIRE IS STARTING to break out in this wrecked sports car used in test of new Freon extinguisher



IN LESS THAN AN EYE BLINK, Freon floods cockpit to snuff out fire before you even see a flame



fire by smothering or cooling it, Freon 1301 works almost instantaneously by chemically breaking the chain reaction that keeps a fire going. Scientists are not certain exactly what the process is, but they know it works many times faster than ordinary extinguishing agents.

Originally developed by Pyrotec, Inc., of Hingham, Mass., the new instantaneous fire-detection system is now sold by Formula 1 Enterprises, Inc., in New York City. Its most dramatic use to date has been in auto racing where drivers' greatest concern is fire. Jim Patterson, deputy competition director for the Sports Car Club of America, calls fire "auto-racing's greatest safety problem, because—with seat belts, shoulder harnesses, roll bars and other devices—drivers are now relatively well protected against the impact of an accident." There have been three successive fire deaths connected with auto races at Le Mans, France, North Italy's Monza course, and the Monaco Grand Prix. Charles Ford of DuPont's Freon Products Div. heard that Champion driver A. J. Foyt had been badly burned and quoted as saying he would not race again without an automatic fire extinguishing system.

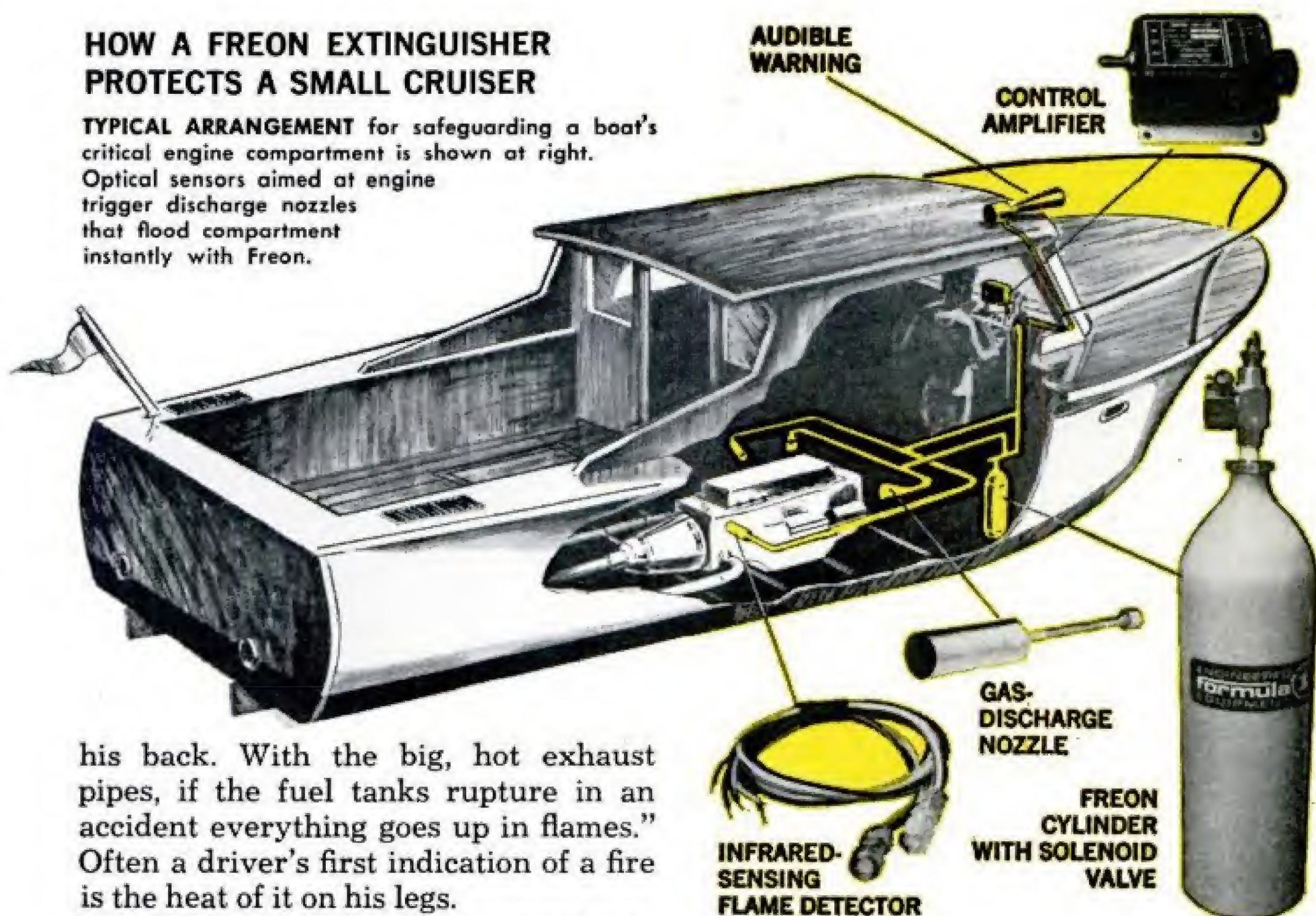
Ford called A. J. to say "I think I've got something to keep you out of trouble." The driver welcomed the idea and DuPont's expert on firefighting turned to Pyrotec, which custom-made a system for both of Foyt's cars for the Indianapolis race. After seeing it, the Ford Motor Co. had similar systems installed in its seven cars to be driven at Le Mans.

Charles Ford sees the racing car as "virtually a gas tank on wheels. The entire front is all gas tank except for the radiator and an area, the size of a basketball, through which air passes; gas tanks extend along both sides of the driver who is practically lying on

RACING CHAMPION A. J. Foyt (at center in photo at left) confers with the inventor of the Freon extinguisher, DuPont's C. L. Ford at right. Foyt was first driver to adopt the system for his cars. At left is Foyt's father, Tony, his chief mechanic

HOW A FREON EXTINGUISHER PROTECTS A SMALL CRUISER

TYPICAL ARRANGEMENT for safeguarding a boat's critical engine compartment is shown at right. Optical sensors aimed at engine trigger discharge nozzles that flood compartment instantly with Freon.



his back. With the big, hot exhaust pipes, if the fuel tanks rupture in an accident everything goes up in flames." Often a driver's first indication of a fire is the heat of it on his legs.

In the new system, the optical sensors "see" the cockpit and release the Freon at the first sign of flame. Even in the inferno of burning gasoline all over the track, an "extinguishing atmosphere" can be established around the driver for 15 to 20 seconds with a small Freon system. This, hopefully, will protect the driver long enough for him to unbuckle and escape or for track people to pull him free or reach him with major firefighting equipment.

The value of an optical detection system lies in its speed, for the light of a fire occurs simultaneously with the flame whereas heat takes time to build up sufficiently to affect a detector some distance away. However, an optical detector must be placed so that nothing will block its view of the area to be protected. Several sensors are often used to "watch" from different angles.

To make certain that the system reacts only to flame and not to ordinary light, it uses a clever triggering device sensitive to infrared radiation, found to a much greater degree in fire than in

daylight. This is done with two infrared-sensitive photocells connected together by a center tap. One cell is covered with a red filter and the other with a green filter. Under ordinary light, the electrical resistance of the two cells is equal. Electricity flowing through the circuit passes through the red cell, across the center tap connection and out the green cell to ground.

As soon as a fire breaks out, the increased infrared radiation passes through the red filter on the first photocell and lowers the cell's resistance sharply. Most of the infrared is blocked by the green filter, however, so that the resistance of the second photocell remains virtually unchanged. Electricity flowing through the red photocell is suddenly faced with a higher resistance in the green photocell. Instead of passing through the green cell to ground, it takes the path of least resistance and flows down the center tap. This triggers an amplifier that, in turn, opens a

(Please turn to page 244)

Now: 'Hands Off'

When it comes to making tricky—and dangerous—deck landings, the computer is surer than the human pilot. The Navy's new automatic system proves that.

By JOHN D. BURLAGE and H. RAY HENDLEY

Illustration by Fred L. Wolff



- | | |
|---|----------------|
| 6 | WAVE-OFF |
| 5 | 10 SECONDS |
| 4 | COMMAND CONT. |
| 3 | COUPLER AVAIL. |
| 2 | ALS LOCK-ON |
| 1 | CHECK-OFF |

Landings on a Carrier

DROPPING to under 1000 feet, the Navy pilot jockeys his jet into the approach path for landing aboard the USS *Forrestal*. Big as she is, the 70,000-ton carrier looks almost like a toy from four miles away, a pitching, rolling toy

in an angry Atlantic. Landing a jet on the flight deck of a carrier is never a picnic, even under the best conditions. But when the weather is bad, with the deck rising and falling as much as 20 feet, it can be a nightmare. A miscue means, at



A PLANE CAN BE LANDED every 30 seconds by the All-Weather Carrier Landing System. Incoming aircraft are first picked up by long-range radar. At 10 to 20 miles from the carrier, the pilot receives signals that guide him to a proper glide-path position. About four miles from the ship, the plane enters the acquisition window. By throwing a switch, the pilot couples in the automatic system, letting the ship's computer "take the controls" of the plane for a "no-hands" flight deck landing

best, a wave-off that sends the pilot around for another try; at worst, an accident, perhaps injury or death.

The pilot heading for the *Forrestal* has hundreds of carrier landings under his belt. Yet he wonders how this one will work out. Responding to a signal from the carrier, he throws a switch on the instrument panel. Soon the plane begins to buffet, slightly but steadily. This is a new experience for the pilot, but he has been told to expect it.

Now he does an unusual thing: He removes his hands and feet from the flight controls. Yet the plane continues to sweep in toward the carrier, right on the proper glide path. The touchdown is smooth, and the plane's tailhook grabs the No. 3 arresting cable for a good landing. The pilot grins and gives a "thumbs up" signal to show his approval of the Navy's new automatic landing system.

This landing is typical of more than 1000 made since 1967, when the Navy started evaluating its All-Weather Carrier Landing System (AWCLS). Today, "hands off" landings are an established fact. One carrier and two aircraft squadrons are equipped and qualified for AWCLS operation. Within the next three years, 11 other carriers and over 2000 naval aircraft will be provided with the same capability.

It took more than two decades of ex-

He removes hands and feet from flight controls. The plane continues to sweep in

perimentation and trial-and-error efforts to develop a reliable system. In 1963, for example, the USS *Midway* put to sea to test the AN/SPN-10 system, forerunner of today's AWCLS. Twelve F-4 Phantoms, rigged for automatic landings, were used. The results were later reported as follows:

"The object was technical and operational evaluation. The results were almost catastrophic. Equipment relia-

bility was so poor that a large team of engineers and technicians was hard pressed to obtain any flights."

The AWCLS system was developed by Navy and civilian personnel assigned to the Navy Air Control and Identification Systems (NACIS) Project Office, Washington, D.C. The two top men in NACIS are Capt. Frederick R. Fearnow and his civilian deputy, John L. Loeb, an engineer widely recognized for his work on the Tactical Air Navigation System (TACAN), an operational instrument guidance system.

In 1964 Capt. Fearnow was given the job of developing a reliable system. He explains that automatic landings are needed in normal sea-air operations, not just in bad weather.

"I've read too often about aircraft going into the drink when weather was not even a factor," he says. "Or of a plane hitting the ramp and taking the ship out of action temporarily. These are the kinds of incidents we hope the system will eliminate."

Weather, of course, increases the hazards. Conditions of reduced visibility, absence of exterior visual references, and the presence of turbulent air coupled with the roll, pitch and heave of a carrier deck add to the danger of making a carrier landing.

NACIS engineers tackled the problem by adding refinements to the AN/SPN-10 hardware, making full use of new advances in electronics and computer technology. A digital computer is at the heart of the new system.

AWCLS is composed of three major systems:

- A shipboard complex of solid-state hardware that includes precision tracking radar units, data stabilization equipment, tracking and navigation computers and display/control consoles. Designated AN/SPN-42, this complex is an improved version of the AN/SPN-10. The computer is fed information relative to ship and aircraft motions and attitudes. These inputs are processed by the computer, which then

sends command signals to the aircraft. In this way, the plane is "aimed" at a rectangle 20 feet wide and 120 long, where it touches down and catches an arresting cable.

- The AN/ASW-25A—the airborne part of the system—is a microelectronic data link about the size and shape of a cigar box. It receives the signals from the AN/SPN-42 and triggers proper responses by the aircraft.

- The AN/SPN-41. Also called C-SCAN (Carrier System for Controlled Approach of Naval Aircraft), it is completely independent of the other AWCLS components. It was designed to provide the pilot with a method of monitoring exactly how his aircraft was reacting during an automated landing. It worked so well in its own right, however, that it is also to be installed in older carriers and aircraft (those not receiving the AWCLS components) for use as a primary instrument-landing-aid system. C-SCAN consists of two shipboard transmitters that send coded microwave signals to the aircraft, and airborne equipment that receives the signals, decodes them and presents the information on cockpit display indicators that can be easily monitored by the pilot.

The AWCLS system also enables pilots to make carrier landings in two other modes besides the fully automatic. If the system reacts improperly because of partial component failure, for instance, an aviator may override it by taking over the flight controls and using the SPN-41 monitor information to make his own landing. Or he may permit an air traffic controller manning the carrier's SPN-42 console to "talk" him down by radio-transmitted instructions.

In operational use, the AWCLS will be the final stage of a carrier-landing system that will begin functioning while an incoming plane is still many miles from its carrier.

First, the aircraft will be picked up by long-range search radar and TACAN. These aids will vector the

pilot onto a final approach course. At 10 to 20 miles from the carrier, he will begin to receive SPN-41 signals to guide him both in line-up and glide-path position until he couples into the automatic landing system 4 to 8 miles from the ship.

Once he has thrown the switch coupling in the automatic system, the pilot can sit back and monitor the sys-

No more than a foot deviation between what radar "sees" and plane's actual position

tem. His plane is firmly in the grasp of the SPN-42 data-link combination. With a retractable corner reflector near the nose of the plane as a focusing point, the SPN-42 radar obtains data on elevation angle, azimuth angle and range. The information obtained is so accurate that there is no more than a foot deviation between what the radar "sees" and the plane's actual position in space.

The SPN-42 radar data is fed to the system's data stabilization unit, which also receives inputs from ship's motion sensors—gyros and accelerometers that acquire information on pitch, roll, yaw and vertical motion of the touchdown point.

The data stabilization unit also provides outputs of the aircraft's actual horizontal and vertical position to the navigation computer, which determines the plane's position to the left or right of a center line and its deviation in elevation from a selected glide slope.

Coupling what it receives with known performance limits for the type of aircraft being controlled, the "nav" computer issues pitch and roll commands to the aircraft through the data link transmitter. The data link transmits the commands to the plane's autopilot.

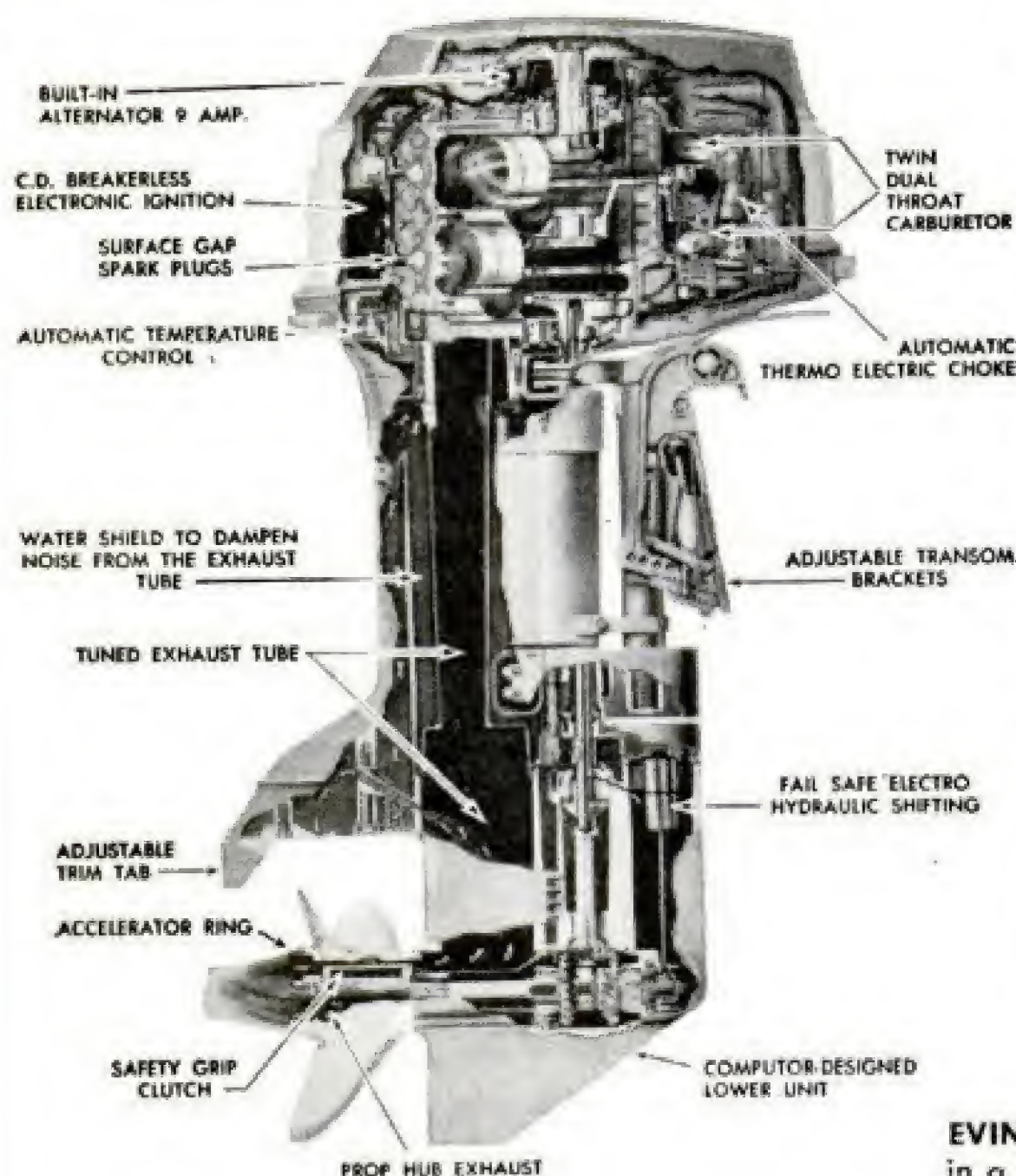
The aircraft responds, pitching up or

(Please turn to page 238)

'70

A Fine-Tuning Year for Outboards

By DAN FALES



More horsepower, major technical changes, name changing—all are part of the new lines of outboard motors.

THERE'S BIG NEWS in the outboard-motor field. But what's important to you is that just about every manufacturer is improving and fine-tuning his product from last year.

The big news is that McCulloch is out of the outboard-motor business entirely. Aeroceanic of California bought the McCulloch outboard division lock, stock and barrel. More big news is that Yamaha is regrouping in the outboard field and will introduce big changes in model designs. Yamaha isn't saying just when.

Kiekhaefer Mercury still leads the

EVINRUDE'S 115-hp Starflite is shown at the left in a full cutaway rendering. Evinrude has 15 models

POPULAR MECHANICS

outboard horsepower race. Merc has a 135-hp production model with a 140-hp racing motor. But Chrysler is right behind it with a 135-hp racing motor.

Johnson and Evinrude, right in there fighting, have announced a new 60-hp model with loop scavenging.

Seagull is staying with its popular Century and Silver Century lines. The Silver Century packs 25 percent more power than the same size Century.

Sears is cutting back, sticking to low-power motors—3.6, 5, 7.5 and 9 hp.

Ward, too, is staying in the popular ranges with 3.5, 6 and 9.3-hp. models.

Though there was a rumor last year that Fisher-Pierce might come out with a smaller motor, the present word is that only the popular 55-hp Bearcat will be available.

Mercury's big news this year is that the direct-charging system announced last year for the 80-hp model is now being used in the 135, 115 and 40-hp

JOHNSON is bringing out the 60-hp Sea Horse, a much improved version of last year's 55-hp model. It features a new porting system in the cylinders



OCTOBER 1969



MERCURY'S 135-hp outboard (above) is largest of 10 power ratings being offered in 1970. Company is introducing the Merc 400 with direct charging

motors. Using this type of cylinder-scavenging in the 40-hp Merc 400 is news, as is the fact that Merc has dropped its old 35-hp model in favor of the 40.

Merc is also adding Perma-Gap spark-plugs which it claims will last for the lifetime of the engine under normal operating conditions. This new plug will be in all models, as will be Merc's Thunderbolt ignition. Breakerless igni-

tion will be on models ranging from 40 to 135 hp; Maker-Point Thunderbolt on the 4 through 20-hp motors.

Chrysler has a 135-hp motor which is classed as a limited-production model used for racing. But the 120-hp Chrysler is a full-production motor. It's at the top of a 43-model line that boasts models from 3.6 to 120 hp.

The new 120-hp unit is a four-cylinder, high-compression engine boasting a new exhaust system, Molybdenum-filled piston rings and Chrysler's Magnapower—a capacitor-discharge ignition system.

Chrysler has introduced an all-new molded plastic ignition switch which is water and corrosion-proof, plus a new concentric-float carburetor that prevents spilling of fuel when the engine is tilted up. It also offers a new accessory called Capac—an anticorrosion kit that protects outboards and stern drives.

Johnson Motors has redone its 55-hp loop-scavenging motor of last year to come up with a 60-hp version. This new three-cylinder, loop-scavenging powerplant has the same bore and stroke as last year's 55. Increasing the horsepower was accomplished by adding a third intake passage in the cylinder sleeve called a power port. The motor has increased compression ratio and easier breathing through a carburetor silencer. A new pressure-back piston ring also helped develop more horsepower. Technical improvements in other Johnson motors give quieter operation and better performance.

Evinrude Motors has 15 models in 11 power ratings ranging from 1.5 to 115 hp. The newest motor, the three-cylinder, 60-hp Triumph, has a loop-scavenging system. Electro-hydraulic gear shifting is a feature of the 115 and 85-hp models. This system eliminates the danger of being stranded in your boat if the shift mechanism fails.

On Evinrude's 18 and 25-hp models, starter interlock has been added. And on the 4-hp motor there's 360° pivoting and an "up" operating position. ★★



FISHER-PIERCE Bearcat is still the only four-cycle outboard among U.S. makes, has four cylinders and carries a power rating of 55 hp

WARD'S Sea Kings this year are designed for fishermen rather than the high-horsepower speedsters



ALL THE OUTBOARDS FOR 1970

Hp	Cylinders	Weight	Bore & Stroke	Displacement	Starting
CHRYSLER					
135	4	235 lbs.	3.312" x 2.800"	96.55 cu. in.	electric
120	4	248 lbs.	3.312" x 2.800"	96.55 cu. in.	electric
105	4	248 lbs.	3.312" x 2.800"	96.55 cu. in.	electric
85	3	221 lbs.	3.312" x 2.800"	72.39 cu. in.	electric
70	3	221 lbs.	3.312" x 2.800"	72.39 cu. in.	electric
55	2	140 lbs.	3.187" x 2.800"	44.7 cu. in.	electric
45	2	127 lbs.	3.125" x 2.750"	42.18 cu. in.	manual*
35	2	127 lbs.	3.000" x 2.540"	35.9 cu. in.	manual*
20	2	79 lbs.	2.437" x 2.140"	19.96 cu. in.	manual*
9.9	2	56 lbs.	2.187" x 1.750"	13.15 cu. in.	manual**
7	2	49 lbs.	2.000" x 1.625"	10.2 cu. in.	manual
5	2	47 lbs.	1.875" x 1.625"	8.99 cu. in.	manual
3.6	1	29 lbs.	2.062" x 1.562"	5.18 cu. in.	manual

*Electric model available

**Autoelectric model available

EVINRUDE					
115	4	252 lbs.	3.438" x 2.588"	96.1 cu. in.	electric
85	4	252 lbs.	3.375" x 2.588"	92.6 cu. in.	electric
60	3	207 lbs.	3" x 2-11/32"	49.7 cu. in.	electric
40	2	156 lbs.	3-3/16" x 2-3/4"	43.9 cu. in.	electric*
33	2	140 lbs.	3-1/16" x 2-3/4"	40.5 cu. in.	electric*
25	2	81 lbs.	2 1/2" x 2 1/4"	22.0 cu. in.	manual**
18	2	80 lbs.	2 1/2" x 2 1/4"	22.0 cu. in.	manual**
9 1/2	2	60 lbs.	2-5/16" x 1-13/16"	15.2 cu. in.	manual
6	2	51 lbs.	1-15/16" x 1 1/2"	8.84 cu. in.	manual
4	2	35 lbs.	1-9/16" x 1 1/8"	5.28 cu. in.	manual
1 1/2	1	20 lbs.	1-9/16" x 1 1/8"	2.64 cu. in.	manual

*Also available with manual starting

**Also available with electric starting

FISHER-PIERCE					
55*	4	239 lbs.	2.75" x 2.50"	59.4 cu. in.	electric

*Four-cycle engine, the only such outboard available in the United States today

JOHNSON					
115	4	252 lbs.	3.438" x 2.588"	96.1 cu. in.	electric
85	4	252 lbs.	3.375" x 2.588"	92.6 cu. in.	electric
60	3	207 lbs.	3" x 2-11/32"	49.7 cu. in.	electric
40	2	156 lbs.	3-3/16" x 2-3/4"	43.9 cu. in.	electric*
33	2	140 lbs.	3-1/16" x 2-3/4"	40.5 cu. in.	electric*
25	2	81 lbs.	2 1/2" x 2 1/4"	22.0 cu. in.	manual**
20	2	80 lbs.	2 1/2" x 2 1/4"	22.0 cu. in.	manual**
9 1/2	2	60 lbs.	2-5/16" x 1-13/16"	15.2 cu. in.	manual
6	2	51 lbs.	1-15/16" x 1 1/2"	8.84 cu. in.	manual
4	2	35 lbs.	1-9/16" x 1 1/8"	5.28 cu. in.	manual
1 1/2	1	20 lbs.	1-9/16" x 1 1/8"	2.64 cu. in.	manual

*Manual starting also available

**Electric starting also available

AEROMARINE					
7 1/2	2	48 lbs.	1-15/16" x 1-45/64"	10 cu. in.	manual*
5	2	39 lbs.	1-15/16" x 1-45/64"	10 cu. in.	manual*
4	1	37 lbs.	2 1/8" x 1 1/2"	5.3 cu. in.	manual

*Electric model also available

MERCURY					
135	6	—	2 7/8" x 2-9/16"	99.812 cu. in.	electric
115	6	—	2 7/8" x 2-3/10"	89.587 cu. in.	electric
80	4	—	2 7/8" x 2-9/16"	66.6 cu. in.	electric
65	4	—	2-15/16" x 2-3/10"	62.35 cu. in.	electric*
50	4	—	2-9/16" x 2 1/8"	43.837 cu. in.	electric*
40	2	—	3" x 2-3/10"	33.3 cu. in.	manual**
20	2	—	2-9/16" x 2 1/8"	21.918 cu. in.	manual**
9.8	2	—	2" x 1-3/4"	11.000 cu. in.	manual
7.5	2	—	2" x 1-3/4"	11.000 cu. in.	manual
4	1	—	2" x 1-3/4"	5.5 cu. in.	manual

*Manual starting also available

**Electric starting also available

MONTGOMERY WARD					
9.6	2	56 lbs.	2 1/8" x 1-11/16"	11.97 cu. in.	manual
6	2	55 lbs.	2" x 1-11/16"	10.6 cu. in.	manual
3 1/2	1	29 lbs.	2-1/16" x 1-9/16"	5.18 cu. in.	manual

SEAGULL					
6 1/2*	1	37 lbs.	2.244" x 1.575"	6.1 cu. in.	manual
5*	1	37 lbs.	2.244" x 1.575"	6.1 cu. in.	manual
4**	1	34 lbs.	2.244" x 1.575"	6.1 cu. in.	manual
3**	1	28 lbs.	1.772" x 1.575"	3.8 cu. in.	manual
2**	1	26 lbs.	1.772" x 1.575"	3.8 cu. in.	manual

*Clutch

**Available in Silver Century model which is 25% more powerful

SEARS					
9	2	49 lbs.	1-15/16" x 1-45/64"	10 cu. in.	manual*
7.5	2	42 lbs.	1-15/16" x 1-45/64"	10 cu. in.	manual*
5	1	37 lbs.	2.125" x 1.5"	5.2 cu. in.	manual
3.6	1	37 lbs.	2.125" x 1.5"	5.2 cu. in.	manual

*Electric model also available

THE 70 CARS

What's New Depends Upon Your Point Of View

By **BILL KILPATRICK**
Auto Editor

Photography by Jeannie Weaver

Five new cars highlight the year's offerings, but 'new' is not necessarily 'new-new'



DODGE CHARGER DAYTONA was designed to win races.

TOM KLEENE is a big, gentle man who smokes a million cigars a day and writes for the business and financial pages of the *Detroit Free Press*. I call on him whenever I can; his affectionate cynicism and great good humor never fail to help knit up "the ravell'd sleeve of care."

"Well, William," he said on a particular day, "what brings you to our fair city this time?"

"The new-car previews," I said.

"Lots of 'bold, new sculptured lines,' I suppose."

"Yep."

"A couple of 'industry breakthroughs,' no doubt."

"The very same."

"Plenty of 'clean, uncluttered styling,' I dare say. 'Exciting, youth-oriented.'"

"Yeah. That, too."

"Everything with a 'long, low, sporty look' and 'all interiors color-keyed with optional accent groups.'"

"Oh, sure. The usual."



period. It typifies Detroit's dedication to speed, come hell or high water. Anyone can walk in off street and buy it

We stopped our game abruptly, both a bit sobered by the thought we were so immersed in the auto industry's clichés they rolled off our tongues like small talk. Somehow it wasn't funny.

So I told Tom about the fellow out at Ford who had just finished a press presentation of the company's 1970 car-engineering highlights. During a question-and-answer period following the presentation, he was fielding reporters' queries about the new 351-CID "Cleveland" V8 engine. He seemed to be having considerable trouble making his point.

"Look," he said finally, a touch of exasperation in his voice, "I hope you guys realize this is a new-new engine, not the new you usually hear about around here."

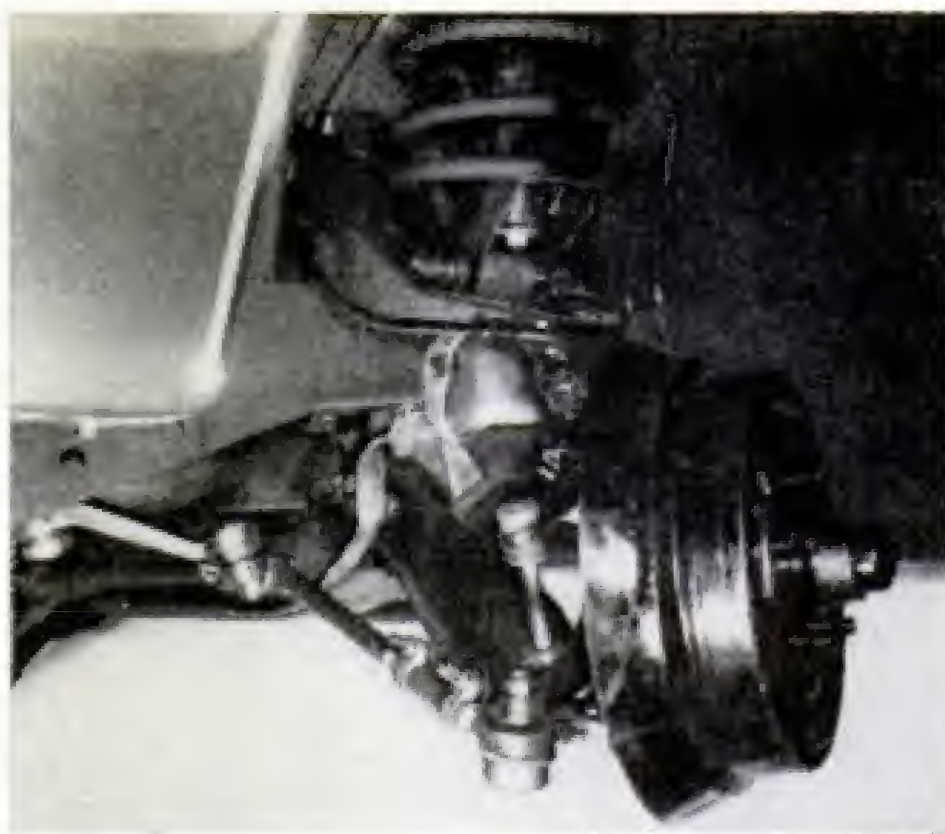
The poor guy had unwittingly laid bare the skeleton in Detroit's closet, the real essence of the 1970 (or any) model year—the usual "new," but not much that's "new-new."

I left Tom and dove for the elevator,

my mind pondering what in the world it is that separates the auto industry from the rest of us. I decided that fundamentally it was a matter of words, what they mean to us and what they mean to the industry. Their "bold, new sculptured line" looks to me like last year's "bold, new sculptured line." But they see it as a revelation, an "exciting new concept." This is okay, I guess, but I just wish auto men weren't so hurt when an outsider points out that the Emperor has no clothes.

Here we have a model year in which, at the very beginning, five new cars are being introduced. Here we have long-wearing, low-profile, bias-belted tires across the board, steering column locks throughout, evaporative emission-control systems, and such engineering exotica as rotating valves, plus a lot of unique, even possibly interesting stuff. But, despite the glowing adjectives, is any of this *really* new? You know better.

The trouble, it seems to me, is that



AMC cars for 1970 offer new twin-ball-joint front suspension. System features antinosedive braking

PONTIAC, on limited basis, will offer a new plastic gas tank on full-size wagons for sale in California

the auto industry is guilty of a sort of ultimate sin—the sin of excess. It's an industry that decides something is good (or at the very least, profitable) and then punches it, kicks it, pummels it, expands it and drives it into the ground, all to excess. Thus we have cars that are too fast and too powerful, cars that are too long, too fat, too complex, too expensive to own and operate. Pinned to the wall on any of these or similar charges, the industry pleads it is merely "giving the public what it wants." That won't march.

The public doesn't want, for exam-

ple, front ends that tend to go out of alignment every time a curb is bumped. It doesn't want erratically aimed headlights. It doesn't want shoddy workmanship, or recall campaigns, or cars that spend too much time in the shop being serviced.

This sort of thing, of course, hasn't gone unnoticed. The federal government in particular is hip-deep in both general and specific inquiries as to how the auto industry conducts its affairs. The Federal Trade Commission, for example, recently began poking

(Please turn to page 217)

AMC HORNET features a straightforward, uncluttered dash panel with easily readable instrumentation





THE 70 CARS

The Really New Ones

New, sure, but out of the ordinary, no

ANY NEW MODEL YEAR that opens with the introduction of five cars never seen by the public before *ought* to be an exciting year, a year that should—at least for the first month or so—see both buyers and just plain buffs storming dealer showrooms to dream and have a look.

Such a year is this one, but my guess is that showroom traffic won't break any records simply because the "show" is about as exciting as two weeks in your back yard. Why? A key, I think, is in defining the word "new."

There are five new cars this year—AMC's Hornet, Chevrolet's Monte Carlo, Dodge's Challenger, Plymouth's Barracuda and Duster. Later on in the model year there'll be even more—a new Camaro, a new Firebird, possibly a surprise or two from Ford. But how *new* are and will these cars be? Based on those covered here (and I've seen and driven all of them), I'd have to answer, "Not very."

Speaking of the five at hand, all are Detroiters in concept, execution and

feel, all feature stuff you've seen, lo, these many moons, and all commit in varying degrees sins universal to the Motown breed—mushy suspensions, something less than exact steering, power that's either a stone or wildly overdone, adventurous braking, slapdash workmanship. And again all—with the *possible* exception of the Hornet, maybe the Duster—are exercises in wish fulfillment rather than the very best cars that can be made for the money.

Does this mean they're bad? Of course not. It simply means they are disappointing. I had hoped for more, cars that somehow in total would reflect that we've put men on the moon, not cars that are a collective rehash of old ideas—good, nicely done, but still clichés.

Here's a closer look:

AMERICAN MOTORS: The Hornet (see photo above) is the entry here. It's offered as either a two or four-door sedan in either a base or SST version. A handsome little car, it features ade-



SPOILER on Dodge Charger Daytona is engineered to help hold car's rear end down at 200-plus mph racing speeds. It's also great for drying wet bathing suits

quate power, better-than-average handling, several little touches missing from comparably-priced (about \$2000) offerings. You'll like the interior room, particularly if you have to ride in back. Oddly enough, there's nothing Spartan about the car; it gives the impression of being a lot more than it really is. Standard engine is a 199-CID Six, the options a 1 or 2-bbl. 232-CID Six, a 304-CID V8. Transmissions, both column-mounted, include a three-speed manual and an automatic. In all, the car is a worthy successor to the Rambler series it replaces and should—if there's any such thing as buyer prudence—prove a winner in the marketplace.

CHEVROLET: Here we have the Monte Carlo, a five-passenger (four with the optional bucket seats) hardtop coupe somewhat scaled down in opulence from the similarly-bodied Pontiac Grand

Prix. It's a so-called "personal" car designed to offer buyers elegance and prestige. Whether or not it succeeds depends upon how far you're willing to let Chevrolet go with a Cadillac vocabulary. It is a nice car—powerful, quiet, good-looking in a middle-of-the-road way, tastefully done inside and out. But it's a Chevy. It *looks* like a Chevy and it *feels* like a Chevy. Still, you ask, is this bad? No, but I find myself wishing the Monte Carlo had proved in its own way to be as radical a departure for Chevrolet as was, say, the Corvette. Then again, I was 30 before I realized "Alice In Wonderland" was fiction. Anyway, you can get the Monte Carlo powered by a 2 or 4-bbl. 350-CID or 400-CID V8. There's a three or four-speed manual transmission or a choice of two automatics. Chevy'll sell 'em by the bushel.

DODGE: What Dodge will be challenging with its new Challenger are the well-entrenched, medium-priced Mercury Cougar and Pontiac Firebird, plus the more posh versions of the Mustang and Camaro. And, happily for Dodge, the battle is being joined with a formidable weapon. The Challenger, particularly in the Special Edition (SE) versions, is an outstanding example of the genre. It's low, sporty, sleek, offers both power and "comfort and convenience" options up to here. You can get the car as either a two-door hardtop or a convertible in both the base and R/T versions plus, in either price range,

(Please turn to page 217)

THE REALLY NEW ONES

Car	Wheel-base (in.)	Track (f/r. in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
American Motors (Hornet)	108	57.5/57.0 57.2/56.6 (V8 models)	179.3	71.1	199-6-1bbl., 232-1&2bbl., 304-2bbl.
Chevrolet (Monte Carlo)	116.0	60.3/59.3	205.8	75.6	350-2&4bbl., 400-2&4bbl., 454-4bbl.
Dodge (Challenger, R/T)	110	59.7/60.7	191.3	76.1	225-6-1bbl., 318-2bbl., 340-4bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2&4bbl.
Plymouth (Valiant, Duster, 340)	108	57.4/55.6	188.4	71.6 71.1 (4dr.)	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.
(Barracuda, Gran Coupe, 'Cuda)	108	59.7/60.7	186.7	74.9	225-6-1bbl., 318-2bbl., 340-4bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2&4bbl.

*Not all engines available in all models

THE 70 CARS

The Really New Ones



DODGE CHALLENGER is offered as either two-door hardtop or convertible with a wide range of engine options. Car also offers such safety innovations as door guard rails, a beefed-up roof structure

PLYMOUTH DUSTER tops Valiant line, is offered only as two-door coupe in high performance, standard versions. Car is very good-looking outside, neatly done inside, may be surprise car of the year



CHEVROLET MONTE CARLO is new entry in personal luxury-car field, is available only as five-passenger two-door hardtop coupe. Car offers long list of built-in luxury features, broad array of options

PLYMOUTH BARRACUDA offers distinctive front-end styling featuring unique fog lamps, turn signals recessed in grille in 'Cuda series. Available as either a two-door hardtop coupe or a convertible



THE 70 CARS

The Compacts



FORD MAVERICK remains the same as when introduced last spring—a two-door fastback powered by either the standard 170-CID Six or optional 200-CID Six

IF OUR CRYSTAL BALL has the right sheen and is properly wired and tuned in, and if straws in the wind are anything other than flying debris, the 1970 model year should be a dandy for compacts. Why?

For one thing, the classification offers two new cars (perhaps three if we include Ford's Maverick, tabbed a '70 when it was introduced last spring)—AMC's Hornet and Plymouth's Valiant Duster, both described under "Really New" (see page 107) and both certain to build traffic in dealer showrooms.

For another, tight money coupled with a growing awareness by buyers that Detroit's compacts add up to attractive buys should focus attention on the smaller cars. If, for example, money-in-hand dictates a choice between, say, a full-sized Chevy Biscayne without airconditioning and a Nova

with air, a lot of buyers are going to opt for the latter.

And with good reason. Compacts, as we've pointed out before, are excellent value. True, they're subject to the same vagaries of assembly and operation as their bigger and higher-priced kin, but for some reason such nonsense doesn't seem as painful with a smaller car; as if a stalled compact isn't quite as useless as a stalled Cadillac.

The big rub with compacts—apart from size limitations and somewhat prosaic appearance—has been trade-in value; dealers just didn't want to see 'em on their used-car lots. But now demand for used compacts is (and presumably will continue to be) up. So if there's a new car in your immediate future, give 'em a look. Here's what you'll find:

CHEVROLET: Offered here is a sin-

COMPACTS—HOW THEY COMPARE

Car	Wheel-base (in.)	Track (f/r, in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Chevrolet (Nova, SS)	111.0	59.0/58.9	189.4	72.4	153-4-1bbl., 230-6-1bbl., 250-6-1bbl., 307-2bbl., 350-2&4bbl.
Dodge (Dart, Custom, Swinger, 340)	111	57.4/55.6	196.2	69.7	198-6-1bbl., 225-6-1bbl., 318-2bbl., 340-4bbl.
Ford (Maverick) (Falcon)	103.0 111.0	55.5/55.5 58.8/58.5	179.3 184.3	70.6 73.2	170-6-1bbl., 200-6-1bbl. 200-6-1bbl., 302-2bbl.

*Not all engines available in all models

gle series—the Nova, available as a two-door five-passenger coupe or a six-passenger four-door sedan. A sporty SS option, which includes a lot of go-go gimmickry, is available only on V8-powered coupes with either a manual four-speed or automatic transmission. Don't look for styling changes; there aren't any. There's some new trim styling and color choices, what Chevy calls "refined exterior details," and—ready?—"new slimline sparkplugs for six-cylinder engines" (only 27 calories per plug!). There are three standard engines—a 153-CID Four, a 230-CID Six, a 307-CID V8. The options are a 250-CID Six and, in the SS package, a 350-CID V8. Transmissions include manual three and four-speeds and three automatics.

DODGE: Three series here—the Dart, the Swinger 340 and the Dart Custom. All feature new grilles, longer hoods, new bumpers fore and aft, new interior trim schemes. The base Dart is available as a four-door sedan only, the Swinger and Swinger 340 as a two-door hardtop, the Dart Custom as a two-door hardtop and a four-door sedan. Engines include a 198-CID Six, a 225-CID Six, a 318 or 340-CID V8. Transmissions offered are manual three and four-speed and an automatic. Dodge says the Dart was its most successful car last year. No surprise here; it's nifty.

FORD: For the moment, there are two Ford entries: Falcon and Maverick. Falcon may be dropped after the first of the year. For now, the base Falcon and Falcon Futura are available as two and four-door sedans and wagons with no significant style changes. Engines are a 200-CID Six and a 302-CID V8, transmissions a three-speed manual and an automatic. Maverick remains the Maverick—a trim two-door fastback powered by a 170-CID Six or an optional 200-CID Six. Transmissions are a three-speed manual and an automatic. ★ ★ ★

OCTOBER 1969



CHEVROLET NOVA offers few, if any, styling changes, is available as a two-door coupe, a four-door sedan. In SS version (coupe only), car adds up to a brisk performer



DODGE DART features a new grille, longer hood, minor trim changes inside and out, new front, rear bumpers. Car is available as base Dart, Custom, Swinger and 340



FORD FALCON is carried over from '69, may in fact be dropped after first of the year. Car is available as a two-door or four-door sedan, a four-door station wagon



PLYMOUTH GTX leads an intermediate line that features restyled grilles, fenders, hoods. Also offered is new power option



BUICK GS features restyled grille, rear-end treatment, new functional air scoops in hood. GS combines muscle with luxury



CHEVROLET CHEVELLE offers new rear styling with taillights, backup lights recessed in bumper. Front has been face-lifted



THE 70 CARS The

A CLASSIC EXAMPLE of something referred to earlier—words losing their meanings in the Never-Never Land of the auto industry—can be found in Detroit's description of the 1970 intermediates. The manufacturers tend to say something along the lines of the cars being "all-new from the ground up." But between us, I'm hard-pressed to see how.

Moving a decal from here to there, making almost microscopic changes in a grille, or lengthening or shortening of things fractions of an inch do not, to my mind, an all-new car make, certainly not one "all-new from the ground up." Yet this is what "they" would have us believe.

Still, my sour grapes and low-baloney threshold can't detract

PONTIAC GTO tops line that includes the Tempest, LeMans, LeMans Sport. Concealed windshield radio antenna will be standard



MERCURY CYCLONE GT offers new grille, a longer wheelbase, more overall length, wider front, rear tread, redone rear end

Intermediate Cars

from the 1970 intermediates as being good cars, cars well-suited to the job(s) for which they were designed; i.e., plain or exotic transportation at a reasonable size and a reasonable price.

Apparently, buyers agree with the concept. Intermediates this past year grabbed off a larger share of the overall auto market than did any other type of car. This year they could make even deeper market inroads, probably at the expense



OLDSMOBILE 4-4-2 continues as muscular head of Olds mid-size line. Others in series are the F-85, Cutlass and Cutlass Supreme



AMC REBEL is offered as two-door hardtop, four-door sedan, wagon in both the base and SST series. There's no convertible

DODGE CORONET features new double-loop bumpers, split grille, revamped hood, rear-deck lid

FORD TORINO series ranges from Fairlane 500 to posh Torino Brougham, offers new grilles, long, lower look



INTERMEDIATES—HOW THEY COMPARE

Car	Wheel- base (in.)	Track (f/r, in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
American Motors (Rebel)	114.0	59.9/60.0 59.7/60.0 (V8 models)	199.0	72.2	232-6-1&2bbl., 304-2bbl., 360-2&4bbl., 390-4bbl.
Buick (Skylark, 350, GS, GS 455)	112 116 (4dr.)	59.0/59.0 59.4/59.0 (GS 455)	200.7 204.7 (4dr.)	75.6	250-6-1bbl., 350-2&4bbl., 455-4bbl.
Chevrolet (Chevelle Malibu, SS 396)	112.0 116.0 (4dr.)	59.0/59.0	197.2 201.2 (4dr.)	76.0	250-6-1bbl., 307-2bbl., 350-2&4bbl., 396-4bbl., 400-4bbl. 454-4bbl.
Dodge (Coronet Deluxe, 440, 500, R/T, SuperBee)	117	59.7/58.7 59.7/59.2 (V8 models)	209.7	76.72	225-6-1bbl., 318-2bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2bbl. & 4bbl.
Ford (Fairlane 500, Torino, GT, Brougham, Cobra)	117	60.5/60.0	206.2	76.7 76.8 (Sports Roof) 76.4 (4dr.)	250-6-1bbl., 302-2bbl., 351-2&4bbl., 429-4bbl., 429-4bbl. in "C", CobraJet & Cobra Jet HO performance versions
Mercury (Montego, MX, Cyclone, GT, Spoiler)	117.0	60.5/60.0	209.9	77.3	250-6-1bbl., 302-2bbl., 351-2&4bbl., 429-4bbl., 429-4bbl. in CJ, Ram Air & NASCAR performance versions
Oldsmobile (F-85, Cutlass, Supreme, 4-4-2)	112.0 116.0 (4dr.)	59.0/59.0	203.2 207.2 (4dr.)	76.2 76.8 (4dr.)	250-6-1bbl., 350-2&4bbl., 455-4bbl.
Plymouth (Belvedere, Satellite, Sport Satellite, Road Runner, GTX)	116	59.7/58.7 59.7/59.2 (V8 models)	204.0	76.36	225-6-1bbl., 318-2bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2bbl. & 4bbl.
Pontiac (Tempest, LeMans, LeMans Sport, GTO)	112 116 (4dr.)	61/60	202.5 206.5 (4dr.)	76.7	250-6-1bbl., 350-2bbl., 400-2&4bbl., 455-4bbl. *Not all engines available in all models

of the traditional full-sized offerings.

On tap for '70:

AMERICAN MOTORS: The entry here is the Rebel, a car that comes in either the base or SST series and is offered as a two-door hardtop, a four-door station wagon. AMC has reworked the roof panels, rear fenders, sedan rear door panels, bumpers and the grille-headlamp arrangement—all only slightly. Standard engine is the 232-CID Six with 304, 360 and—in the SST—390-CID V8s being the options. Transmissions include a standard three-speed manual and an automatic for either steering column or console.

The Rebel has a "no nonsense" air about it I find appealing.

BUICK: These handsome intermediates are offered as the Skylark, Skylark 350, Skylark Custom, Sportwagon, GS and GS 455. The Skylark and GS series each has its own distinctive grille, with the GS offering functional air scoops in the hood. A new "Stage 1"

performance package is available in the GS 455 series. Styling changes are minor, the highlight being a side panel character line that begins along the front fender, fades, then reappears along the rear fender. Cars are available as two-door coupes, two-door hardtops, four-door sedans, convertibles, four-door wagons. Engines include a 250-CID Six, a 350-CID 2 or 4-bbl. V8, and a 455-CID 4-bbl. V8, transmissions a three-speed manual and an automatic.

This is a handsome line of cars, among the best-looking Buick has ever produced.

CHEVROLET: Offered here is the Chevelle Malibu as a two-door hardtop coupe, a four-door hardtop sedan, a four-door sedan and a convertible. Featured throughout are a new grille, hood and fenders, plus new front and rear bumpers and minor ornamentation changes. There's also new interior

(Please turn to page 220)



FORD THUNDERBIRD styling this year is all-new up front, features longer, lower hood, bulging grille

THE 70 CARS

The Personal Cars

Lots of flash, but few real changes

STRIP AWAY everyone's rationale for buying, say, a four-door sedan, and underneath we'll probably find a heart that secretly beats for one of these lithe, sleek beauties—the so-called “personal” car.

Even Dad, the Little Woman and kids in tow and determined to buy a “sensible” car, will cast a longing eye at a flashy low-slung little job over in a showroom corner. The cars in this classification are so blatant in their appeal to the blythe spirit within us all it's almost depressing; *no* one should know *that* much about us.

But the auto industry's styling and

marketing wizards have us perfectly pegged. They know we're all hung up on exotica and, being first, last and always businessmen, can't crank out these gratifying, self-aggrandizing symbols fast enough. Symbols of what? Oh, of youth, of freedom, of never having to pay the piper. In the “personal” car is distilled everything—every nuance—of America's never-ending love affair with the automobile.

On tap for '70:

AMERICAN MOTORS: Two cars here—the Javelin and the AMX, both a bit longer but changed very little from their immediate model-year predeces-



BUICK RIVIERA gets a major facelifting this year. There's a new grille, longer hood, new bumpers fore and aft, new body molding, new wider rear window



OLDS TORONADO features a new grille, new front-rear bumpers, new deck lid and taillight setup, new dash layout, and—praise be!—a pushbutton ashtray



CHEVROLET CAMARO is carried over as is for the time being. There'll be an all-new, completely restyled Camaro introduction early in 1970

DODGE CHARGER this year features new loop bumper, new front fenders. Also new is a lower-priced version—called, simply, Charger—featuring bench seats and a more modest trim package



THE 70 CARS

The Personals



AMC JAVELIN gets minor facelifting, features refinements both inside and out. Car is slightly longer than last year, a shade lower. New for '70 is a special safety windshield designed to reduce possibility of cuts in a crash



PONTIAC FIREBIRD, also a carryover, will debut as an all-new car after the first of the year. Car is offered as a convertible, a hardtop coupe in versions from mild to very warm, including the Trans-Am with racy spoiler

MERCURY COUGAR is up more than two inches in overall length, features restyled grille, headlamp covers. Models in series include basic Cougar, posh XR-7, high-performance Eliminator



AMC AMX is a bit longer, a bit lower for '70, features new power, performance options including new hood with ram-air power blister. Car remains two-seater, is offered only as coupe. As with Javelin, AMX features special safety windshield



FORD MUSTANG is revamped front and rear, features a number of interior and exterior styling refinements. Car is offered as hardtop, convertible, sports roof in versions ranging from the base model to all-out Boss 302, Boss 429, Mach 1, and the posh Grande hardtop



CHEVROLET CORVETTE, carried over intact from '69, is still industry's only stab at a true sports car



PONTIAC GRAND PRIX for new model year is the same Grand Prix we've all come to know and love

sors. The Javelin is again offered as a two-door coupe in base and SST versions. There's a new hood featuring simulated air scoops, new trim and decorative options inside and out. Standard Javelin power is a 232-CID Six with 304-CID, 360-CID (2 and 4-bbl.), and 390-CID (4-bbl.) V8s the options. Transmissions include three and four-speed manuals and an automatic.

In the AMX—still a two-seat, two-door coupe—standard power is the 360-CID V8 with the 390-CID V8 the option. AMX transmissions include a floor-mounted four-speed manual and an optional console-mounted automatic. Inside the AMX (the Javelin, too)

you'll find new high-back bucket seats, a new instrument panel layout, a new (and welcome) glove box arrangement.

In all, not much new with either the Javelin or the AMX, but both are stylish, very much "with it" cars.

BUICK: Riviera is the name of the game here and—by Detroit standards—the car has been extensively restyled. Up front you'll notice a new, uncluttered grille, a longer hood, a new bumper. Along the sides you'll see a new twin-stripe molding and new rear-wheel-opening covers. There's a new rear bumper, a wider rear window. In-

(Please turn to page 223)

PERSONAL CARS—HOW THEY COMPARE

Car	Wheel- base (in.)	Track (f/r, in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
American Motors (AMX) (Javelin)	97.0 109.9	59.1/56.6 59.3/57.0 59.1/56.6 (V8 Models)	179.0 191.0	71.6 71.9	232-6-1bbl., 304-2bbl., 360-2&4bbl., 390-4bbl.
Buick (Riviera)	119.0	63.44/63.00	215.5	79.30	455-4bbl.
Chevrolet (Corvette) (Camaro)	98.0 108.0	58.7/59.4 59.6/59.5	182.5 186.0	69.0 74.0	350-4bbl., 427-(3)2bbl. & 4 bbl. 230-6-1bbl., 250-6-1bbl., 307-2bbl., 350-2&4bbl., 396-4bbl.
Dodge (Charger, 500, R/T)	117	59.7/59.2	208.5	76.6	255-6-1bbl., 318-2bbl., 383-2&4bbl., 426-(2)4bbl., 440-(3)2bbl. & 4bbl.
Ford (Mustang) (Thunderbird)	108.0 115.0 117.0 (4dr.)	58.5/58.5 (6-in. rims) 59.5/59.5 (7-in. rims)	187.4 212.5 215.0 (4dr.)	71.7 78.0 77.4 (4dr.)	200-6-1bbl., 250-6-1bbl., 302-2&4bbl., 351-2&4bbl., 428-4bbl. & 4bbl. with Ram Air, 429-4bbl. with Ram Air 429-4bbl.
Mercury (Cougar)	111.1	58.5/58.5	196.1	74.3	302-4bbl., 351-2&4bbl., 428-4bbl., 429-4bbl.
Oldsmobile (Toronado)	119.0	63.5/63.0	214.3	78.8	455-4bbl.
Pontiac (Firebird, Trans-Am) (Grand Prix)	108 118	60/60 62.0/60.0	191.1 210.2	73.9 75.7	250-6-1bbl., 350-2&4bbl., 400-2&4bbl., 428-4bbl. 400-2&4bbl., 455-4bbl.

*Not all engines available in all models



PLYMOUTH FURY has been restyled up front via new bumper, grille. Car's longer, the rear track wider

The Favorite Family Cars

EACH YEAR, it seems, I shuffle out here on stage and gloomily tell anyone who will listen that the full-size, so-called "family" car is a dead duck in the marketplace. So what happens? Each year it rolls merrily along, selling in the millions, its makers wearing big smiles at annual stockholder meetings. Maybe I need a new crystal ball.

Yet (he said, going under for the third time), the concept is doomed. Buyers are paying more attention to the intermediates, the hotshots, the personal cars, the out-and-out luxury jobs. It is, I'm convinced, only a matter of time before sales of the family car drop out of sight.

(Either that or automakers will be reduced to the absurdity of promoting, say, "the biggest intermediate in the industry." Don't laugh. It already happened. Two years ago one outfit was hustling what it called the industry's "biggest compact.")

But until the knell for the family car is sounded, here they are at least one more time:

AMERICAN MOTORS: The Ambassador is a bit longer this year, thanks

mainly to a revamped rear end featuring new fenders, new bumper, new taillight arrangement. Otherwise, things are pretty much carried over as is from '69. There are seven models in the line—a base four-door sedan, and a two-door hardtop, a four-door sedan and a wagon in the DPL and SST series. Air-conditioning is again standard in all Ambassador models. Reclining front seats are available on all SST models. There are five engines, three transmissions. The 232-CID Six is standard on the base line, the 304-CID V8 standard on DPLs and SSTs. Other engines include the 360-CID V8 2-bbl. and 4-bbl., and the 390-CID V8 4-bbl. Transmissions are a column-mounted three-speed manual and an automatic, available for console mounting on SST hardtops.

It's hard to fault the Ambassador, if only because AMC has the good sense not to claim for it virtues just shy of a moonshot. Actually, it's good value in a pretty good car.

BUICK: The LeSabre and Wildcat are the entries here, both featuring new grilles and minor styling refinements

THE 70 CARS

Family Cars



DODGE MONACO, longer in front, shorter in rear, is an inch shorter overall. Rear track is wider. New loop bumpers appear fore and aft. Car is offered as two or four-door hardtop, four-door sedan, wagon

PONTIAC VENTURA, fancy version of the Catalina, features all-new grille, new hood, new fenders, new headlight arrangement and new bumper. Other cars in model line include Executive and Bonneville



BUICK WILDCAT features a new front end highlighting grille, bumper, repositioned headlights, parking lights; plus new two-piece rear wraparound bumper design for tail, turn signal, backup lights

AMC AMBASSADOR is a shade longer overall this year, due mainly to revised rear-end styling. New are the rear bumper, tail-lamp arrangement, rear fenders, roof panel for station wagons





OLDS DELTA 88 is offered as base, Custom and Royale models in two and four-door hardtops, four-door sedan, base convertible



FORD XL series is priced midway in full-sized Ford line, and offered as a two-door hardtop, the line's only big convertible



CHEVROLET CAPRICE tops line that includes Impala, Bel Air and Biscayne. New grille, fenders, bumpers highlight 1970 styling



for 1970. If you look closely, you'll also note a new hood, new front fender caps and a new front bumper. There are some minor styling touches along the sides and around back, but that's about it. There's a base LeSabre, a LeSabre Custom, a LeSabre Custom 455 (in honor of a 455-CID 4-bbl. V8). In the Wildcat there's the Wildcat Custom, period. There is also a separate wagon. In the LeSabre you can get a two-door hardtop, a four-door hardtop, a plush four-door sedan. Same thing in the 455. Only the Custom offers a convertible. Engines are either the 350-CID or 455-CID V8s. Transmissions are a three-speed manual and a three-speed automatic.

These cars—the entire Buick line, in fact—looked good to me this year.

CHEVROLET: The hand of the stylist has been stayed at Chevy for '70. There's a slight grille change, new bumpers front and rear, new headlight framing, new side marker lights, a new hood, 12 new colors. There's also new interior trim styling. The car is offered in four series—top-rated Caprice, Impala, Bel Air and base Biscayne. You can get a hardtop coupe or sedan in the Caprice (V8 power only), a hardtop coupe, sport coupe, sport sedan, convertible or four-door sedan in the Impala. The only Six you can get in the Impala series is on either the sport coupe or the four-door sedan; the others are all V8s. The Bel Air and Biscayne are offered only as four-door sedans with either Six or V8 power. The Six is 250-CID, the V8s 350

MERCURY MARAUDER is available only as two-door hardtop, comes in either base or X-100 versions, the latter being powered by 429 CID 4-bbl. Car is a real marcher

(2 and 4-bbl.) and 400-CID. Transmissions are a three-speed manual and two automatics.

CHRYSLER: The Chrysler was extensively restyled last year, so there's not much new to report other than new grilles on all series, plus a new sound and vibration isolation system said to result in a significant reduction in road noise. Offered are five series of cars—Newport, Newport Custom, 300, New Yorker and a Town & Country wagon. There are two V8s—a 383-CID 2-bbl. and a 440-CID unit that comes with either single or dual exhaust or a potent high-performance package. You can get a three-speed manual transmission in the base Newport, but everything else is automatic. The Newport comes as a two and four-door hardtop, a convertible and a four-door sedan. Same with the Custom, only there's no convertible. The 300 comes as a two



CHRYSLER NEWPORT offers new grille, minor changes. Chrysler claims new sound-vibration system results in noticeable reduction of all road noise

and four-door hardtop and a convertible, the New Yorker as a two and four-door hardtop and a four-door sedan. The wagon is a two or three-seater.

DODGE: New proportions are the big news here. The front end has been

(Please turn to page 230)

FAMILY CARS—HOW THEY COMPARE

Car	Wheel-base (in.)	Track (f/r in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
American Motors (Ambassador)	122.0	59.9/60.0 59.7/60.0 (V8 models)	208.0	77.2	232-6-2bbl., 304-2bbl., 360-2&4bbl., 390-4bbl.
Buick (Le Sabre, Wildcat, "455")	124.0	63.0/63.0 63.5/63.0 ("455")	219.4	80.0	350-2&4bbl., 455-4bbl.
Chevrolet (Biscayne, Bel Air, Impala, Caprice)	119.0	62.5/62.5	215.9	79.8	250-6-1bbl., 350-2&4bbl., 400-2bbl., 454-4bbl.
Chrysler (Newport, Custom, 300, New Yorker)	124	62.1/62.0	225.1	79.0 79.1 (4dr.)	383-2&4bbl., 440-4bbl.
Dodge (Polara, Custom, Monaco)	122	62.1/63.4	220.4	79.3 79.2 (4dr.)	318-2bbl., 383-2bbl., 440-4bbl.
Ford (Custom, 500, Galaxie, 500, XL, LTD, LTD Brougham)	121.0	63.0/64.0	213.9 216.0 (4dr. convert.)	79.7 79.8 (4dr. sedan)	240-6-1bbl., 302-2bbl., 351-2bbl., 390-2bbl., 429-2&4bbl.
Mercury (Monterey, Custom, Marauder, X-100, Marquis, Brougham)	121.0 124.0 (4dr.)	63.0/64.0	219.1 221.8 (Monterey 4dr.) 224.3 (Marquis 4dr.)	79.6 79.8 (4dr.)	390-2bbl. (reg. or prem. fuel), 429-2&4bbl.
Oldsmobile (Delta 88, Custom, Royale)	124.	62.5/63.0	219.1	79.9	350-2bbl., 455-2&4bbl.
Plymouth (Fury I, II, III, Sport Fury, GT)	120	62.1/62.0	215.3	79.5	225-6-1bbl., 318-2bbl., 383-2&4bbl., 440-(3)2bbl. & 4bbl.
Pontiac (Catalina, Executive, Bonneville)	122 125 (Executive, Bonneville)	64/64	217.9 223.9 (Executive) 224.6 (Bonneville)	79.8	350-2bbl., 400-2bbl. (reg. or prem. fuel), 400-4bbl., 455-4bbl.

*Not all engines available in all models

THE 70 CARS

The Luxury Cars

BIG NEWS in the luxury-car field for 1970 centers around a restyled Lincoln and a 500-CID (!) engine for Cadillac's Eldorado. Otherwise, in the best traditions of cars in the luxury category, changes are at a tasteful minimum.

The Lincoln is all-new, and I can't make up my mind whether the Mercury is being upgraded to look like the Lincoln or the Lincoln is being downgraded to look like the Mercury. In any event, there's a definite resemblance, particularly up front.

Cadillac's 500-CID engine is, of course, "the largest passenger-car engine in the world." Cadillac would have it no other way. As usual, unfortunately, we didn't get either pictures or specifications of the new Cadillacs in time to make this issue's deadline, so please pardon the void. But regarding the new engine, we do know horsepower is rated at 400 . . . and this, loafing.

Anyway, here's what the big spenders are being offered for '70.

BUICK: The Electra 225 offers an all-
(Please turn to page 234)

OLDS 98 features a new grille, new hood sheet metal, new bumpers front and back, a side and deck-lid paint-stripe option. The taillights are new



IMPERIAL by Chrysler underwent major restyling in '69, is carried over only slightly changed for the new year



LINCOLN CONTINENTAL is all new, has longer wheel-base, a wider front, rear track, new front, rear suspension



LUXURY CARS—HOW THEY COMPARE

Car	Wheel-base (in.)	Track (f/r, in.)	Overall Length (in.)	Overall Width (in.)	Engines in Model(s) Series* (Displacement, cu. in.—V8 except as noted—carburetion)
Buick (Electra 225)	127.0	63.5/63.0	225.0	80.0	455-4bbl.
Cadillac (Eldorado)	120.0	63.5/63.0	221.0	79.9	500-4bbl.
(Calais, DeVille)	129.5	63.0/63.0	225.0	79.8	472-4bbl.
(Brougham, Sixty-Spec.)	133.0		228.5		
(Seventy-five)	149.8		245.5		
Chrysler (Imperial)	127	62.4/62.0	230.2	79.0 79.1 (4 dr.)	440-4bbl.
Lincoln (Mark III)	117.2	62.0/62.0	216.1	79.4	460-4bbl.
(Continental)	127.0	64.3/64.3	225.0	79.6	460-4bbl.
Oldsmobile ("98")	127.0	62.5/63.0	225.2	80.0	455-4bbl.

*Not all engines available in all models



PM's Handsome Hall Clock

Creating this family heirloom is easier than it looks. Presented in two installments. Part 1 lets you get started on the housing and next month's details finish the job

PART I

By W. CLYDE LAMMEY

Technical Art by Fred Wolff

GREAT GRANDFATHER referred to his timekeeper in the hall as a "tall" clock, never as a "grandfather" clock. Both terms referred to the case, of course. Some early cases were huge and ornate—up to nine feet high and two feet or more wide. PM's version is scaled to suit today's tastes; it's a clock that blends with any decor.

Though the case pictured is sometimes called a three-quarter case, it is more commonly known as "grandmother" size. Such cases usually varied from about 50 to 72 in. (or slightly more) in height with other details in proportion. Our version is $17\frac{3}{8}$ in. wide and about 77 in. high overall.

The movement features visible weights with polished brass shells and chains. It chimes the quarter hours and strikes the hour on rods. The "moon" dial (ordered separately) will keep track of the moon phases, provided it is correctly adjusted and the clock runs constantly. Movement and dial (Model U-10) were purchased from Craft Prod-

ucts, Elmhurst, Ill. 60126, for \$77.

Woods to use are your choice. The case pictured was made from selected curly maple. Mahogany or black cherry are also good choices. Cash outlay for wood was about \$30 from Craftsman Wood Service, 2727 S. Mary St., Chicago, Ill. 60608.

Actually, the clock enclosure is simply three boxes stacked one atop the other. The parts are built using simple construction techniques. Bracket feet, for example, look difficult to make, but aren't. The two parts are bandsawed to rough shape and ends are spline-mitered as detailed. After joining with glue, the triangular filler piece is added and each foot rasped to rough shape.

Next, you make the base frames. The lower one has a plywood panel framed in; the upper one is an open frame to allow the weights to pass through. If you don't have a molding knife of the proper size for shaping the frames, do this by hand (or this could be the project that justifies treating yourself to a

BRACKET FOOT is assembled, shaped to contour with a rasp and file. Finish the smoothing with sandpaper

FEET ARE ATTACHED to base frame with screws and glue. Position the feet with long arms at the front

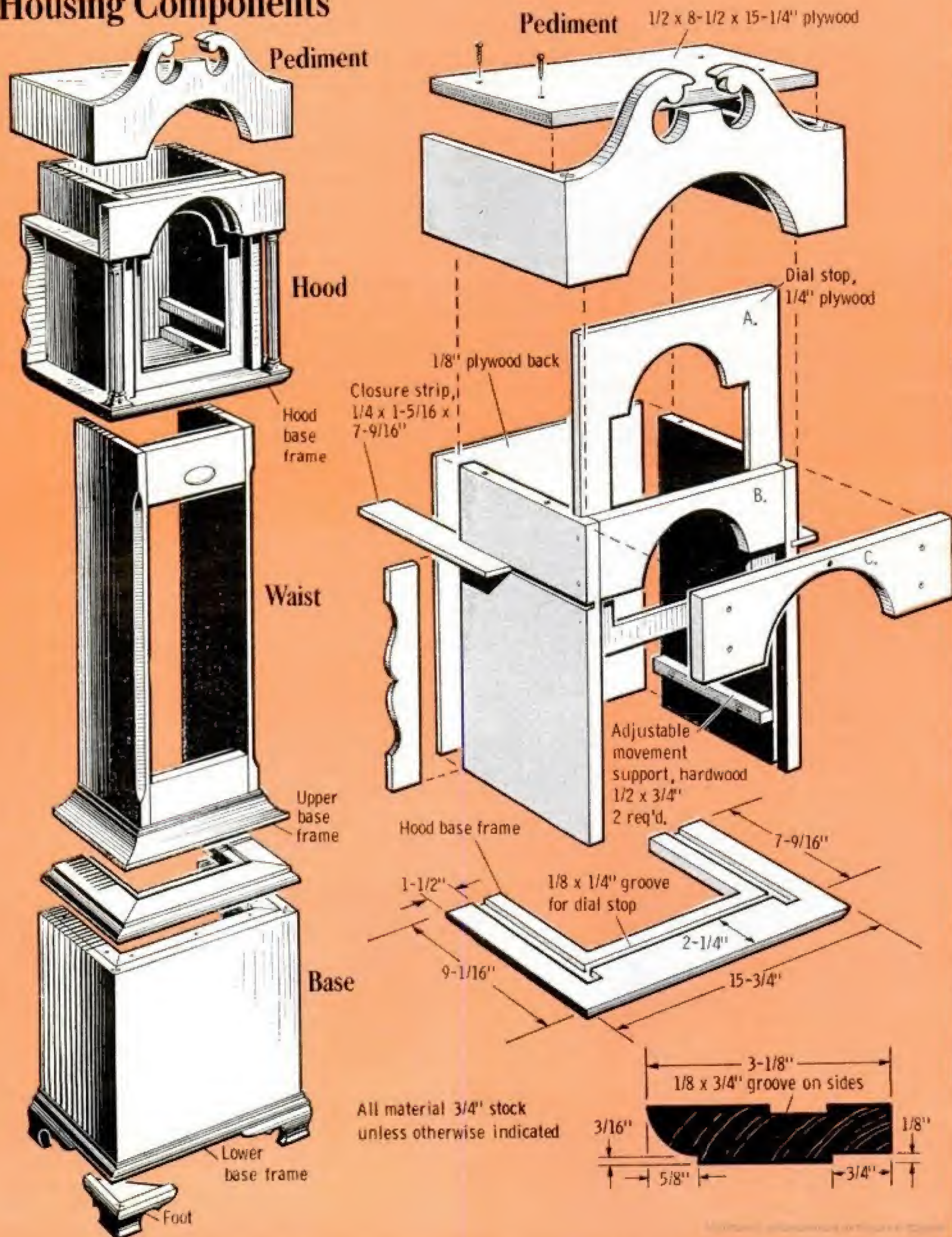


molding head and cutter set). If you do the frame moldings by hand, duplicate the bead (right angle) portion of the shape by ripping a 1/4-in. groove about 1/8 in. deep. Then, using a hand plane, round the edge to shape. Grooves in the mitered corners for the splines are

stopped just before cutting through into the molded edges.

The front member of the three-sided base will require edge-gluing two or more pieces to obtain the necessary width. Select stock so that the boards are well matched for attractive grain

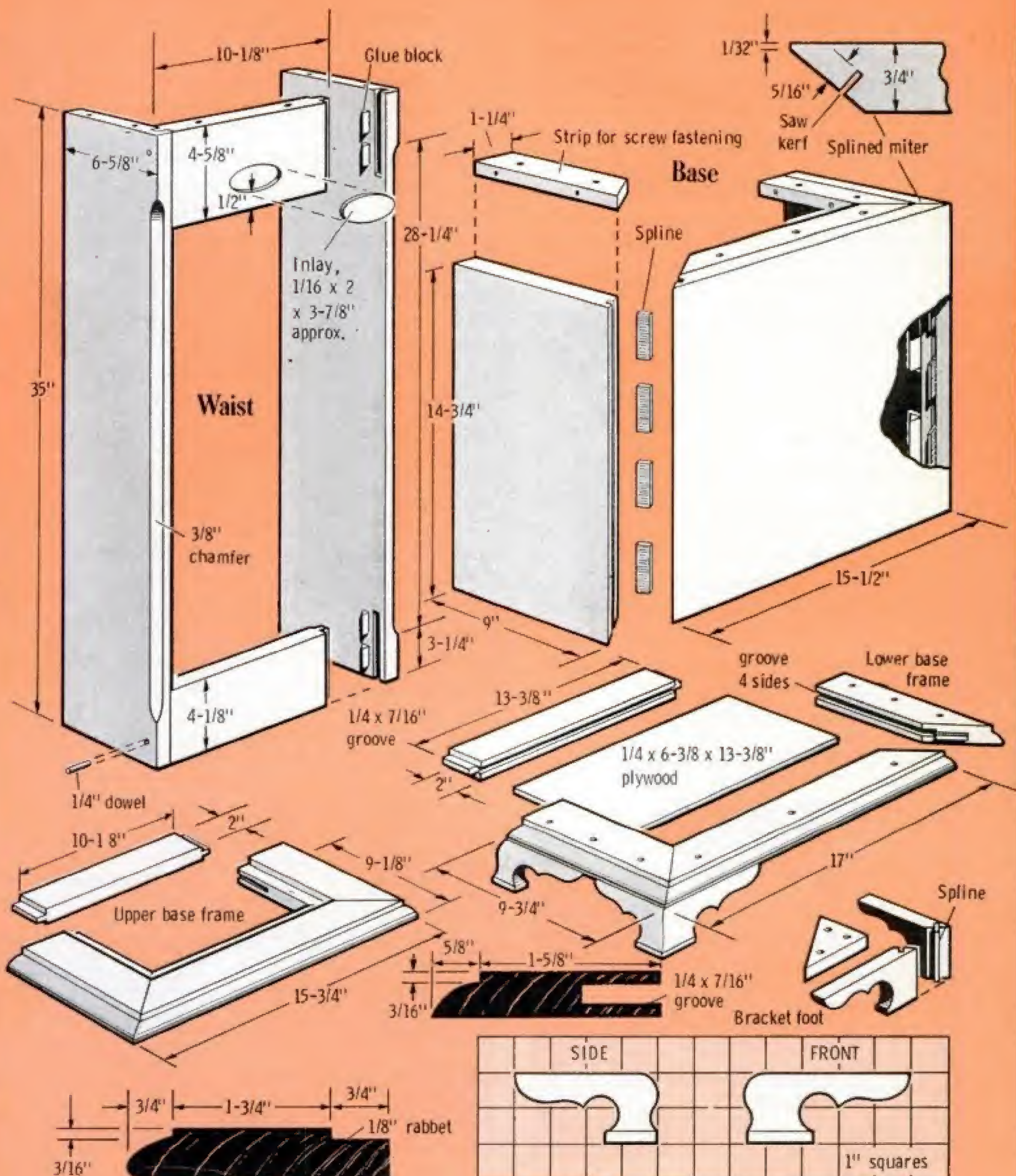
Housing Components



design. Mitered corners are splined. Notice that mitered cuts come to a blunt point. You leave about $\frac{1}{32}$ in. as a bearing against the ripping fence then sand to a corner after joining.

Photos show how the waist, or column, is assembled. The inlaid eagle is a

marquetry assembled from several woods, also sold by Craftsman Wood Service. It should be inlaid carefully to obtain as perfect a fit as possible. The depth of the recess receiving it should insure that the marquetry, when glued in, is slightly above the wood surface;





SCREW-FASTENING STRIPS are glued and screwed inside the three-sided base, flush with the top edge

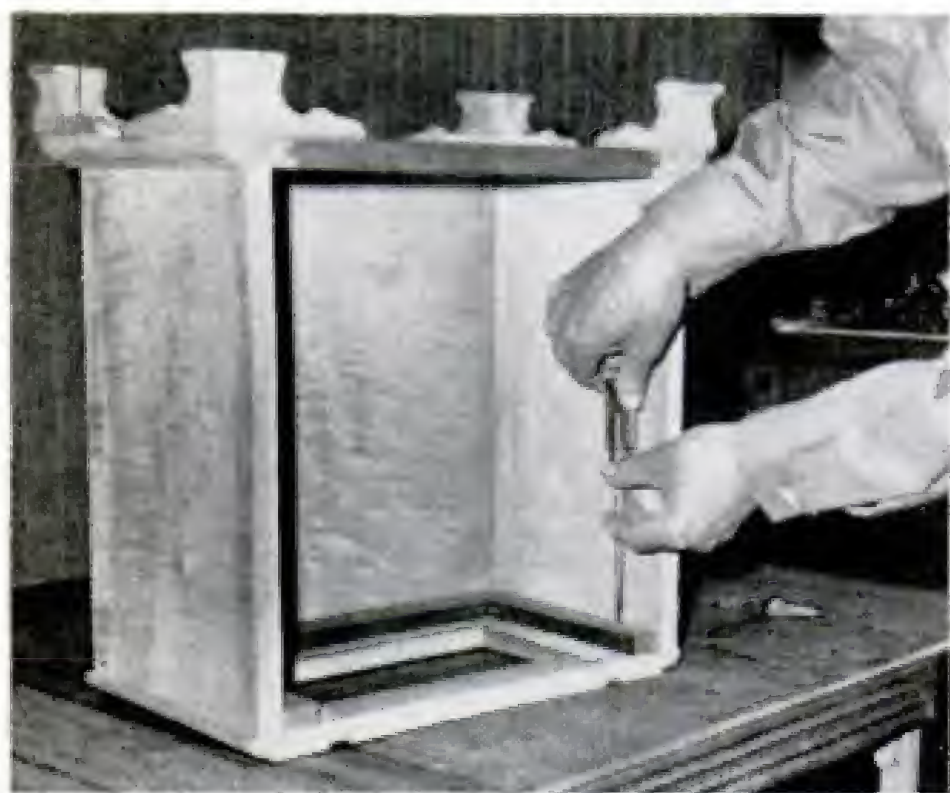
it is then sanded perfectly flush. The joinery at top and bottom is by means of simple grooves and tenons, must be done accurately to insure a neat fit. Cross members and base miter joints are glue-blocked. Each joint, further strengthened with a $\frac{1}{4}$ -in. dowel will be concealed later by cove molding.

Use $1\frac{1}{2}$ -in. No. 4 flathead screws to assemble. Be sure that the base is properly located on the lower frame and make a nonglue test assembly to check for fit.

The strips for screw fastening are attached to the inside of the box, flush with the top. The top frame of the base is then attached with screws.

Next, turn the assembly upside down and install the bracket feet. To make sure the case will stand level when assembled, shim a piece of $\frac{3}{4}$ -in. plywood level on your workbench, and place the assembled base on it. Then check the "stand" of the base with a level. If it is even slightly wobbly, remove stock

BASE IS COMPLETED when upper frame is attached with screws turned up through the fastening strips



LOWER BASE FRAME is attached to the base with screws only in a preliminary non-glue trial assembly

from alternate feet with a rasp until the base stands perfectly level and firm on all four feet.

The waist now can be joined to the base in a trial fitting, leaving the joints dry. This dry run makes it easier and more workmanlike to disassemble the parts for finishing. It's also best to sand individual parts smooth as they are cut to size, and to "soften" (round) all corners slightly as you sand. Finishing stains and varnishes have a tendency to draw away from a sharp corner, thus leaving it unfinished.

The hood and pediment, shown on page 126, will be discussed in detail next month. They demand closer attention to detail and require having the clock movement on hand. Parts could be rough-cut to shape now, but leave ample waste for trimming to exact size.

This completes the basic unit. Next month we'll tackle the two doors and the decorative touches, plus the heart of the clock—the movement. ★★★

WAIST DROPS INTO PLACE in the edge rabbets that are ploughed in the frame parts before assembling



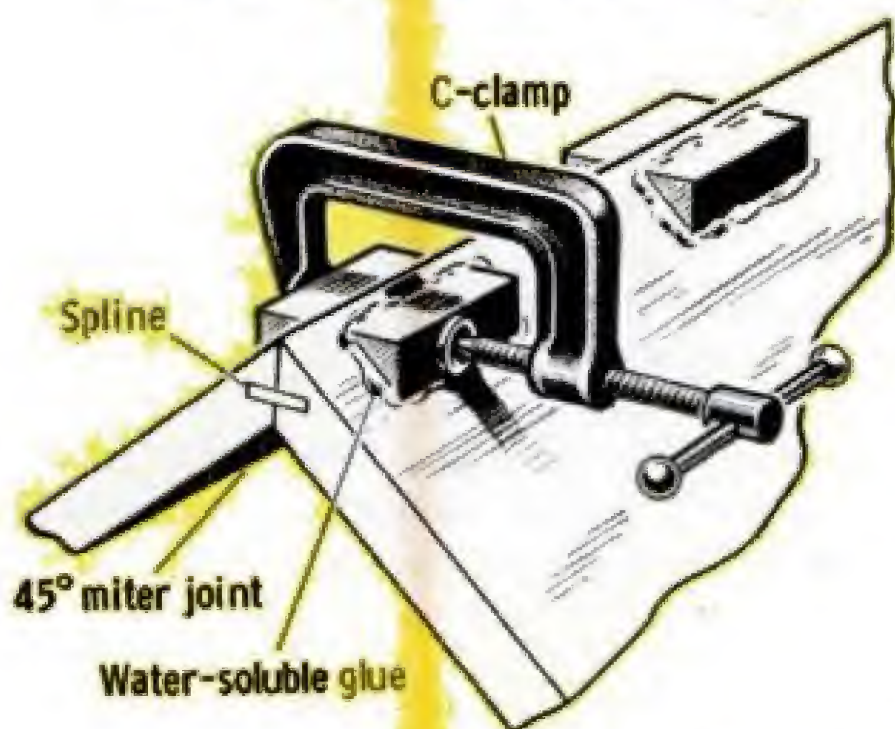


UPPER BASE FRAME is simply a hollow frame permitting weights to fall their required distance



MOLDED EDGE of upper base frame is fully rounded with a block plane, then sanded to a uniform radius

Miter-Joint Assembly



CLAMPING SPLINED MITERS. Triangular blocks are glued near the edges of the pieces to be joined. When dry, the joint is spread with glue and drawn tight with C-clamps. After glue in the joint has dried, the blocks are cut off with a sharp chisel. Use sandpaper to remove any glue that's left on workpiece

SCREWS DRIVEN UP through upper base frame hold the waist securely. Use nine equally spaced screws



MATERIALS LIST

No. Reqd.	Size*	Use
HARDWOOD		
Base		
1	3/4x2 1/4x40"	Bracket feet
1	3/4x4x55"	Base frame (lower)
2	3/4x9x15"	Base sides
2	3/4x8x15"	Base front
Waist (column)		
2	3/4x7x36"	Sides
1	3/4x5x10 1/2"	Top rail
1	3/4x4 1/2x10 1/2"	lower rail
Hood		
1	3/4x3 1/2x36"	Hood base frame
2	3/4x8x17"	Sides
1	3/4x5x11 1/2"	Inner arch (B)
1	3/4x5x15"	Spacer (C)
1	3/4x9x16	Pediment front
2	3/4x5x9 1/2"	Pediment sides
Cove Molding		
1	3/4x2 1/2x84"	Upper and lower
Arched Door		
2	5/8x1 1/2x12"	Stiles
1	5/8x1 1/2x11 1/2"	Bottom rail
1	5/8x5 1/2x11 1/2"	Top (arched) rail
Waist Door		
2	3/4x1 1/2x27"	Stiles
1	3/4x1 1/2x10"	Bottom rail
1	3/4x5x8"	Top rail
Miscellaneous Hardwood		
2	1/4x1 1/2x12 1/4"	Scrolled ornaments
2	1/4x1 1/2x8"	Closure strips
2	1/2x1x6"	Movement seat cleats
1	3/8x3/4x12"	Retaining strip
2	3/4x12" dowel	Pilaster
PLYWOOD		
1	1/2x9x16"	Hood top
1	1/2x11x14"	Chime-rod bracket support
1	1/2x6x11 1/2"	Movement seat
1	1/4x12x17"	Hood dial stop (A)
1	1/4x7x14"	Base
1	1/8x24x48"	Backing
1	1/8x12x36"	Backing

HARDWARE

2 each brass capitals and bases for pilaster; 1 pediment ornament with 2" ball; 1 brass pull, 3/8"; 1 brass pull, 5/8"; 1 pr. 1 1/2" loose-pin hinges; 22-ga. brass for arched door hinges; clock movement and dial.

MISCELLANEOUS

1 2x3 7/8" marquetry inlay (eagle); 1 arched glass panel to suit hood door; 1 rectangular glass panel to suit waist door; assorted flat and roundhead screws; white glue, stain, lacquer, sandpaper.

*Pieces are listed slightly oversize in width and length to allow for finish trimming. Several pieces included in this list are not shown in Part 1. Additional detailed drawings will appear in Part 2 next month.

PM's exclusive preview of

PATEXPO '69

WORLD'S BIGGEST INVENTORS SHOW

On these and the following six pages, PM brings you a behind-the-scenes look at some of the more than 10,000 exciting new ideas to be unveiled later this month at the huge New York Coliseum

By SHELDON M. GALLAGER

INVENTORS FROM ALL OVER the United States and 24 foreign countries are about to gather at Patexpo '69—short for Patent Exposition—to display their latest creations. To bring you the exciting highlights of this important annual event, PM editors studied hundreds of entries in advance by special arrangement with the show's sponsor, the International New Products Center at 680 Fifth Avenue, New York, N.Y. 10019. The show—largest of its kind in the world—will be held at New York's giant Coliseum October 9-12. Exhibit hours are 11:00 a.m. to 8:00 p.m. weekdays and noon to 8:00 p.m. on Saturday and Sunday. Tickets are \$2.50 each.

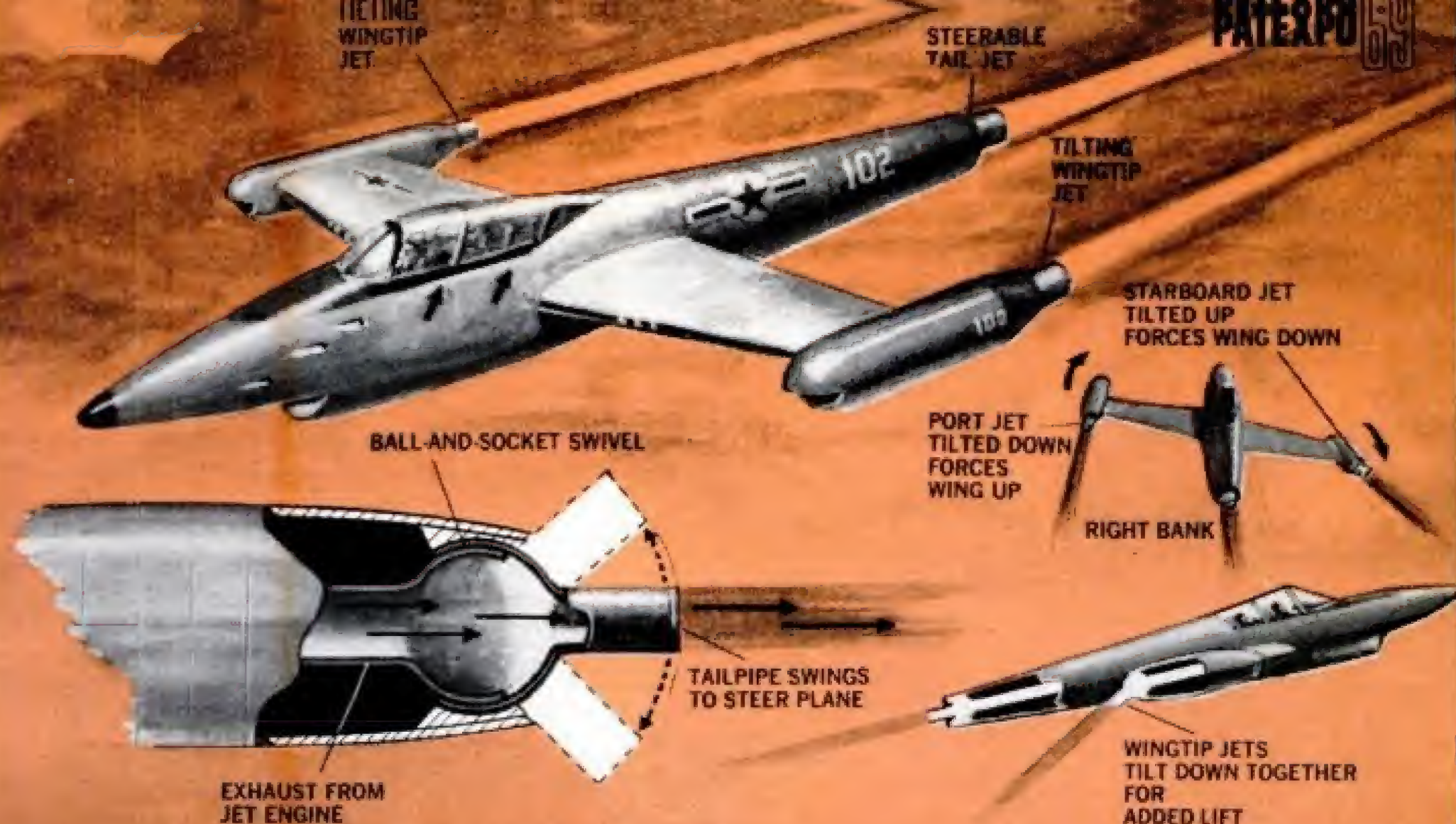
CRATES BECOME CABINS in this clever scheme proposed by William Field of Royal Oak, Mich. Large shipping crates would be made with sloping tops, as in the photo below. Instead of being discarded after use, the crates could be stacked together with

doors and windows added to form cabins, sheds and other small structures. The idea would save millions of dollars of waste a year, says the inventor, and help provide desperately needed housing in underprivileged regions of the world.



STORAGE SHED





TAILLESS FIGHTER uses steerable jets to maneuver with instead of conventional control surfaces. The tail jet moves up and down and sideways for climbing, diving and turning. The wingtip jets can be used to-

gether for added lift or tilted in opposite directions to serve as ailerons for banking. Object: faster, more precise maneuvering in combat with less chance of failure. Sam Fatouras of Chicago is the inventor.



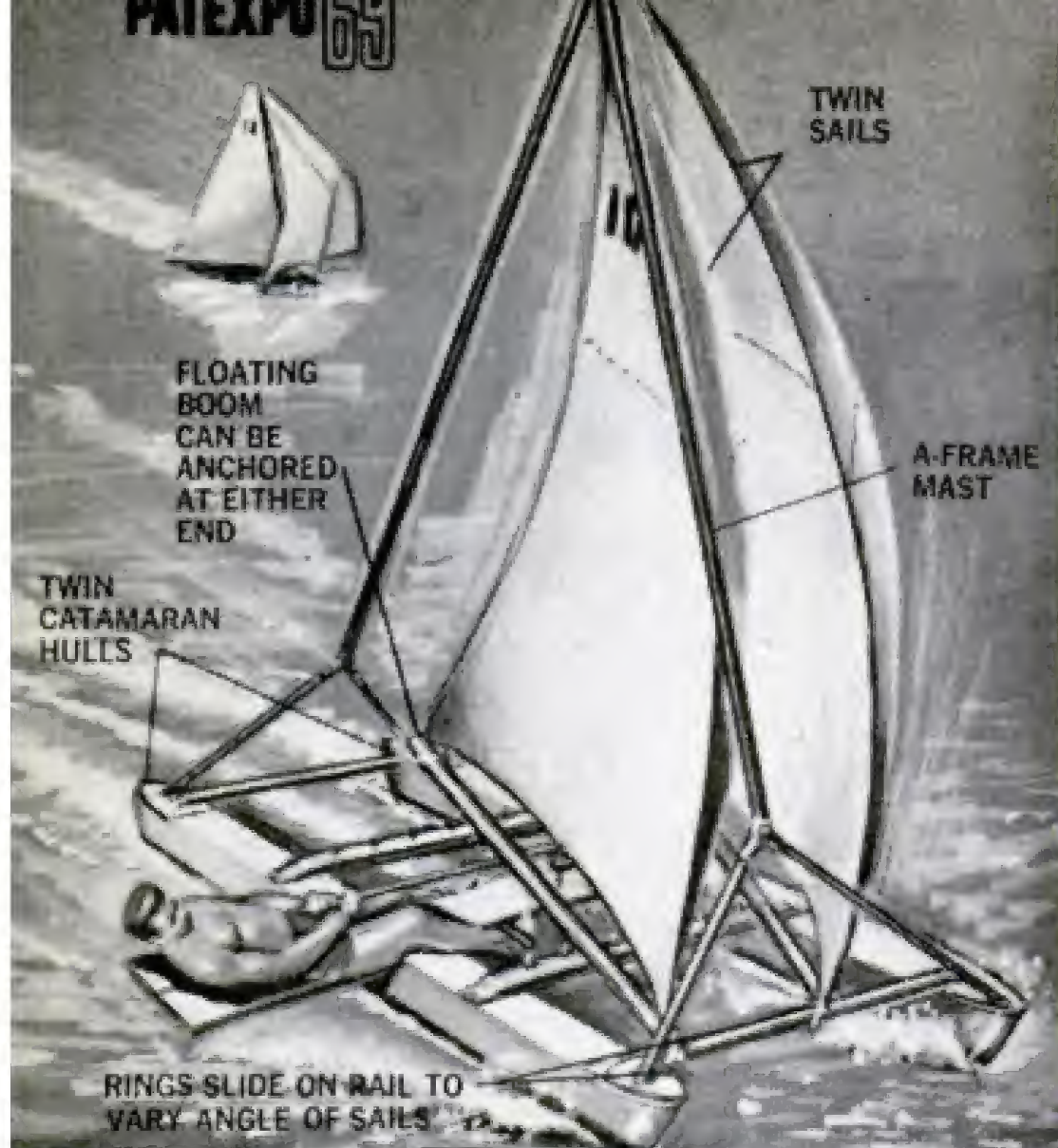
THAT'S NOT ICE they're skating on—it's plastic. Vinyl Plastics, Inc., of Sheboygan, Wis., has devised a system of lightweight plastic panels you can put down over any flat surface—a cellar floor or porch deck—to make an instant, year-round skating rink. The 3 x 8-foot panels are joined with special clips that hold them firmly together.

OCTOBER 1969



COLLAPSIBLE GUIDE POST can be run over with no damage to either it or your car. The spring-mounted plastic post is designed for areas that need markers but not a restraining rail. It saves lives, claims inventor Josef Hausegger of Steiermark, Austria, because cars striking it at high speed don't bounce off to hit other cars nearby.

131

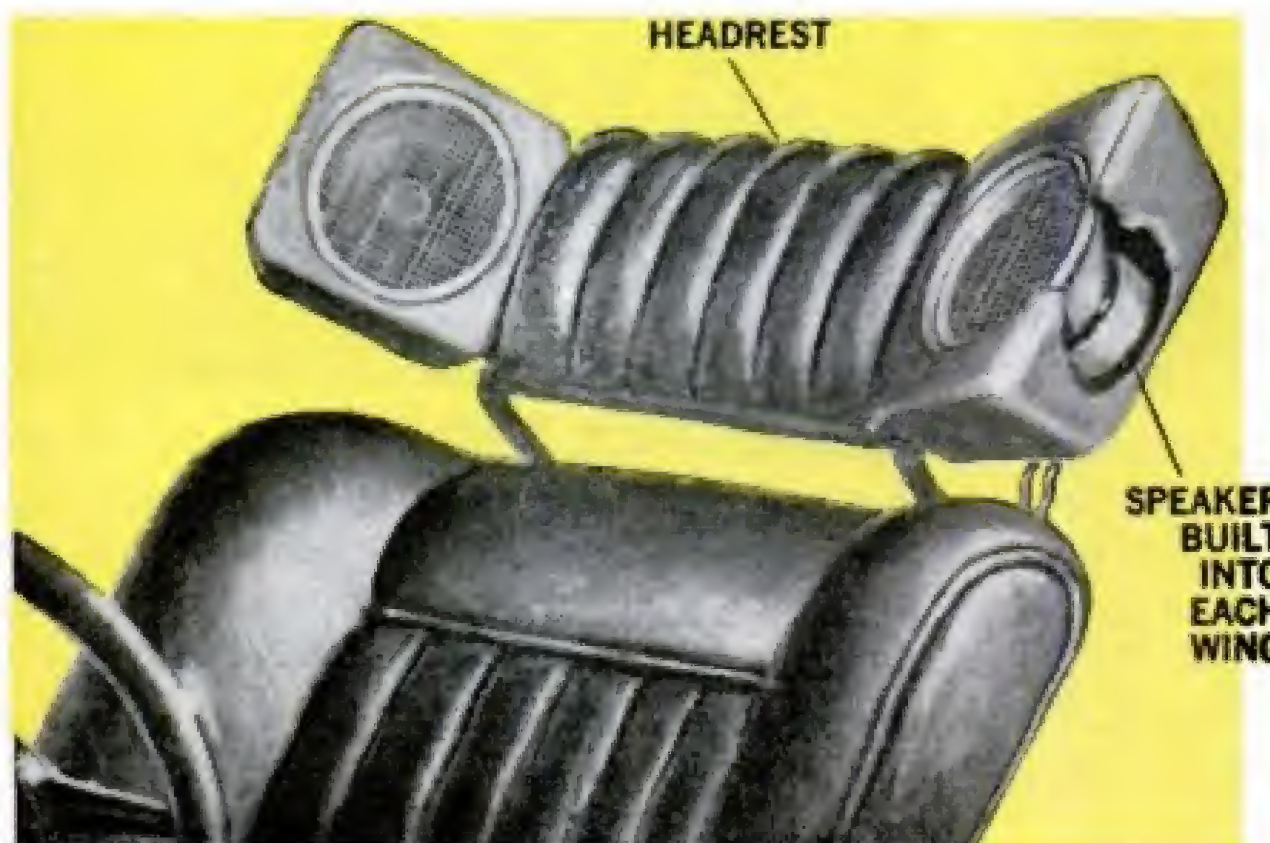


TWIN-SAIL CATAMARAN never has to turn around—it can sail in either direction. The booms are attached by sliding rings to a crossbar at each end of the boat. To go one way, you pull the booms in at one end and let them out at the other. To go the op-

posite way, you merely pull in the free ends and let out the anchored ends, reversing the sails. Advantages: Dangerous jibe turns are eliminated and you don't have to keep switching sides in the boat. Inventor is Friedrich Lucht of Bremerhaven, West Germany.



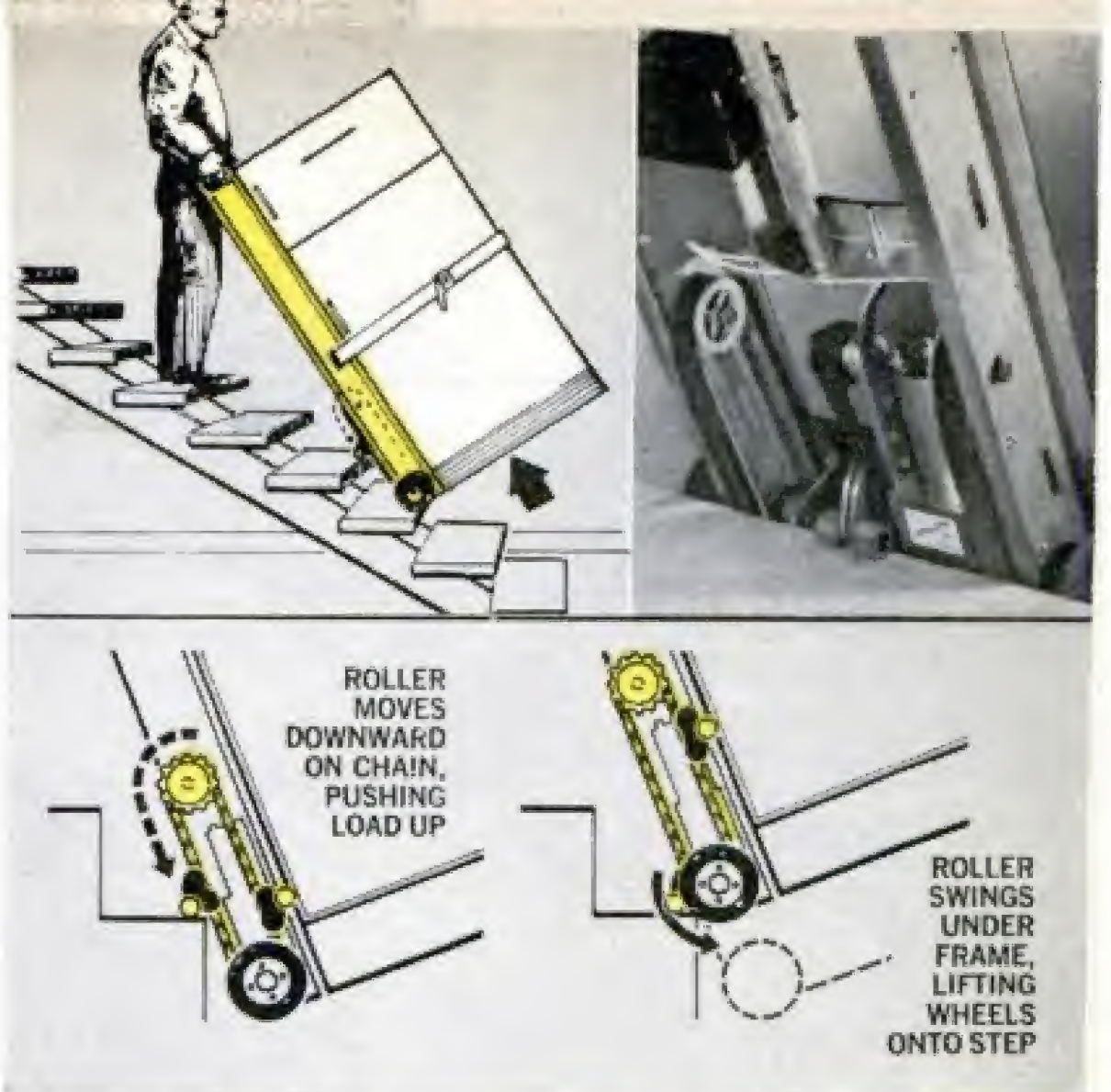
ESCAPE LADDER is hinged to the side of the house in this tricky burglar-proof arrangement by Virgil Teach of Portland, Ore. In a fire, the ladder is unlocked and swung over to the window. When not in use, it's too far from the window for prowlers to use, and the lock can be released only from the window.



BUILT-IN SPEAKERS in this novel headrest for cars surround you with stereo music on long trips. The wraparound shape with the right and left channels fed to opposite ears gives you a stereo effect similar to that of headphones. You can also hook the speakers to a mobile CB or ham set for improved shortwave listening. Spartan Products of Madison Heights, Mich., came up with the idea.

MECHANIZED HAND TRUCK

makes it possible for one man to move a 600-pound load up or down stairs all by himself. Two pairs of small rollers ride on a motor-driven chain between the hand truck's wheels. As each pair moves downward on the chain, it catches on the lip of a step and lifts the hand truck up. As the rollers swing around the pulley at the bottom, they lever the truck's wheels up and onto the step. At the same time, the second pair of rollers catches on the next higher step and the process is repeated. For going down stairs, the battery-powered motor is reversed. The hand truck was developed by Escalera, Inc., of Yuba City, Calif.

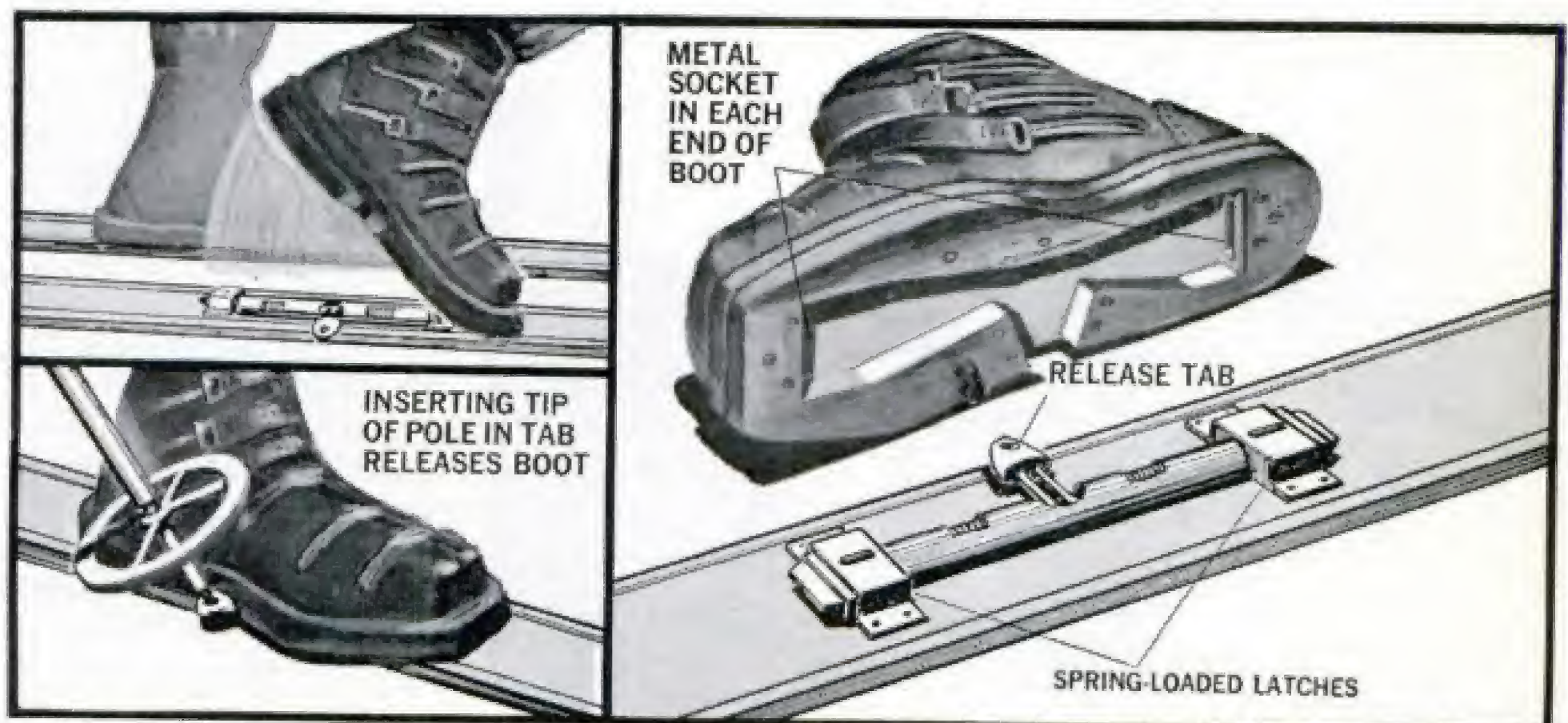


TIRE TELLTALE warns you at a glance if your pressure is low. The indicator, invented by S. M. Ellis of Shorne, England, has a spring-loaded plunger inside. So long as air pressure is adequate, it holds the plunger in the outward position so you can see its colored tip. If the pressure falls, the spring forces the plunger inward, indicating that the tire is soft.



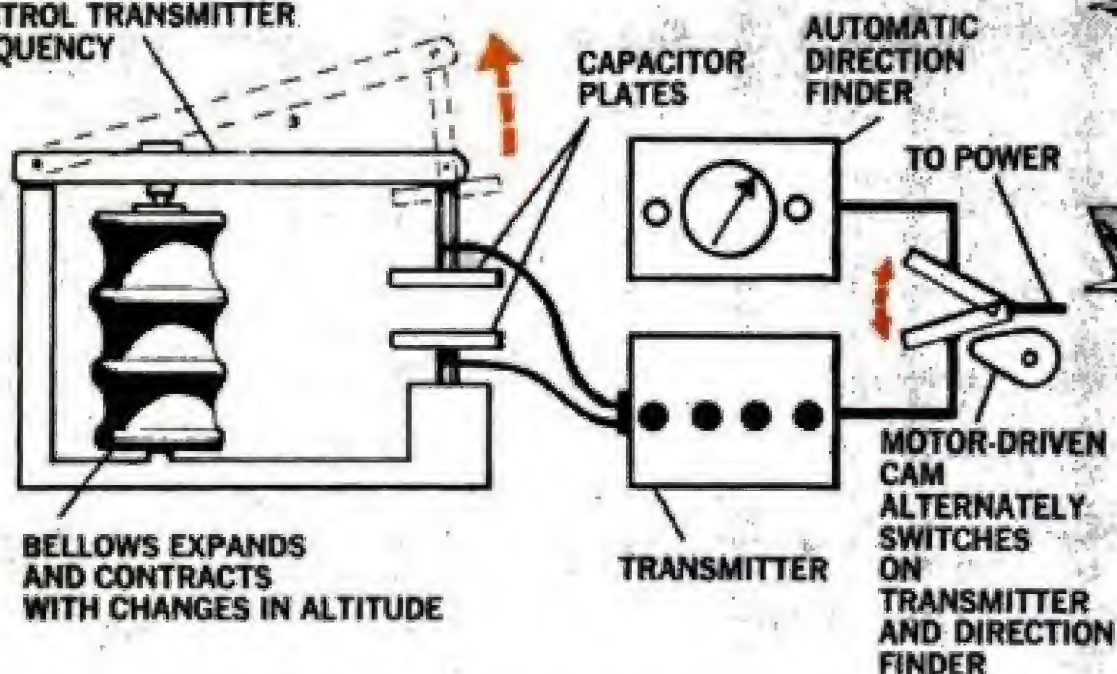
STEP-ON SKI BINDINGS let you put your skis on and take them off without even bending over. You just press down and spring-loaded latches snap into sockets built into the boots. To get out, you push your ski

pole tip into a projecting tab. This retracts the springs, releasing each ski. For safety, the latches also release automatically under a preset pressure if you fall. Henry Glass of Chicago is the inventor.

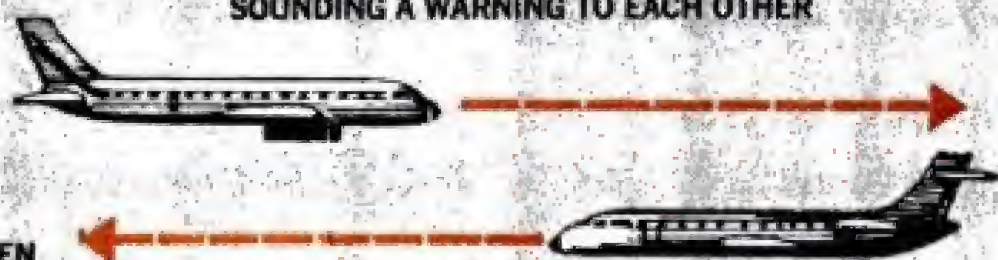




ARM MOVES UP AND DOWN, CHANGING CAPACITANCE TO CONTROL TRANSMITTER FREQUENCY



PLANES FLYING AT SAME ALTITUDE BROADCAST ON SAME FREQUENCIES, SOUNDING A WARNING TO EACH OTHER



PLANES FLYING AT DIFFERENT ALTITUDES BROADCAST ON DIFFERENT FREQUENCIES AND DO NOT RECEIVE EACH OTHER

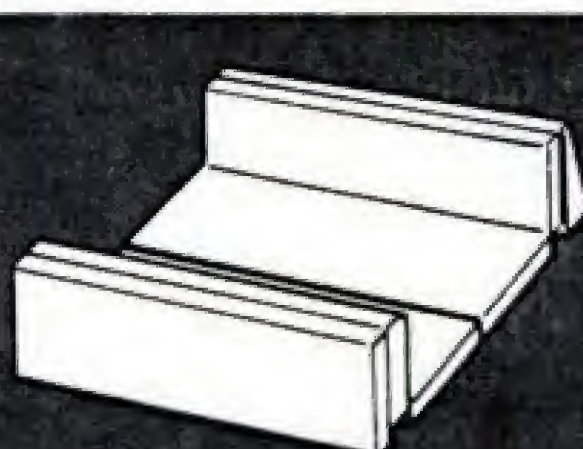
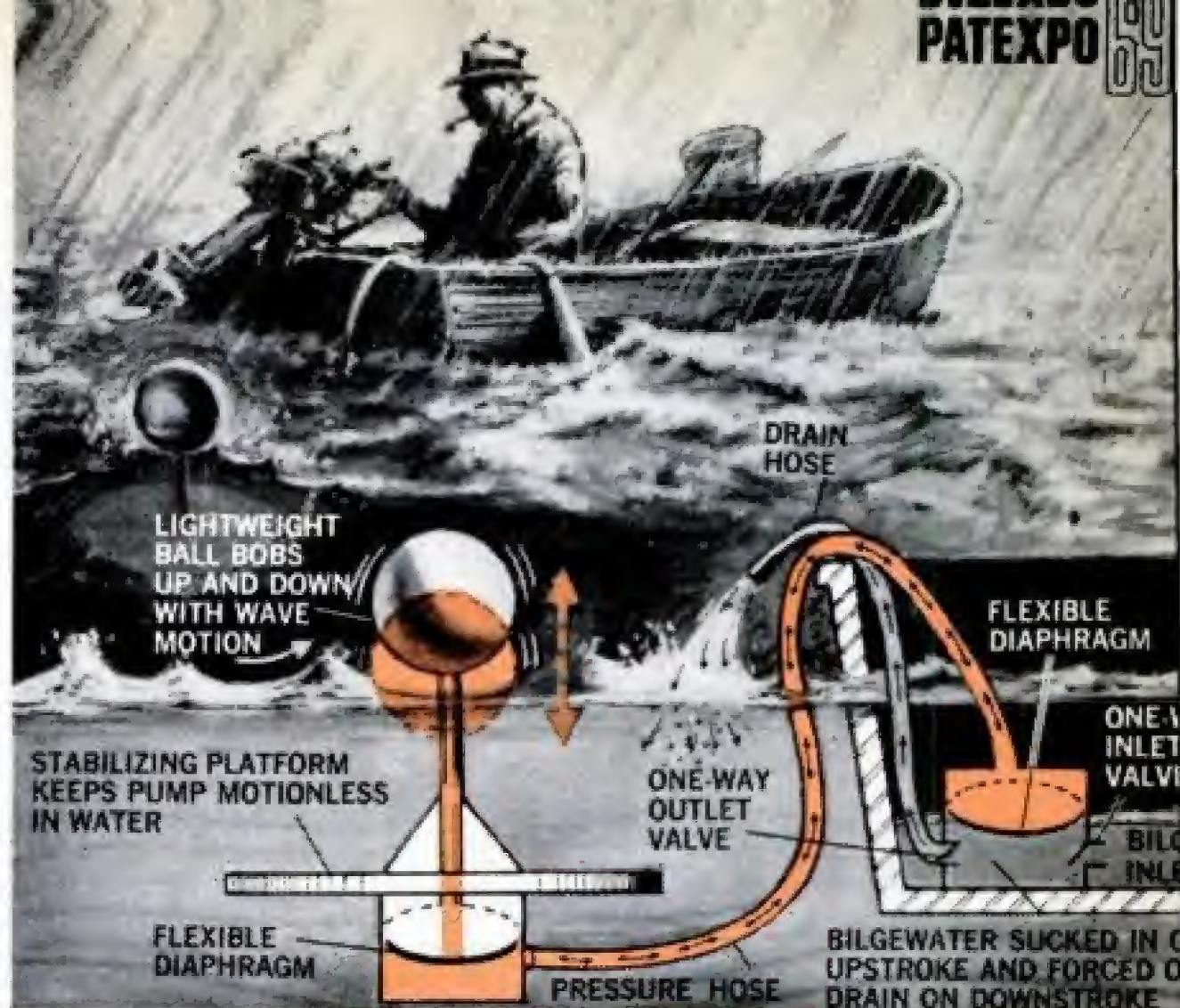
AIRLINERS WOULDN'T COLLIDE with this ingenious warning system devised by Angelo Boudouris of Sylvania, Ohio. Each airliner sends out a signal that varies in frequency according to the plane's altitude. Its direction finder is also controlled by altitude so it receives only the frequency for a par-

ticular elevation. Two planes flying at different altitudes would be on different frequencies and would not hear each other. But the minute they approached the same altitude, they would pick up each other's warning signal. Frequency is controlled by an altimeter-like bellows as shown in the diagram.



PORTABLE BAR can be set up in three minutes before a party, then taken apart and stored away afterward to save space. Made of tough, plastic-impregnated, water-resistant cardboard, it consists entirely of flat pieces that are bent and interlocked to provide strength. When assembled, it can support 200 pounds on top and another 40 pounds on an inside glass and bottle shelf. Plastic Coating Corp. of Holyoke, Mass., designed the fold-up bar.

WAVE ACTION does the work for you in this handy bilge pump invented by Robert Kafka of Maitland, Fla. The pump piston is driven by a ball float that bobs up and down with the motion of the waves. This moves a diaphragm up and down, forcing water through a hose against a second diaphragm in the boat. As the second diaphragm moves up and down, it draws bilge water in through a one-way valve that opens only inward and expels it through another one-way valve that opens only outward. The nice thing about the idea is that, in an emergency, the rougher it is, the harder the pump works—automatically.



PADDED PLAY AREA FOR KIDS

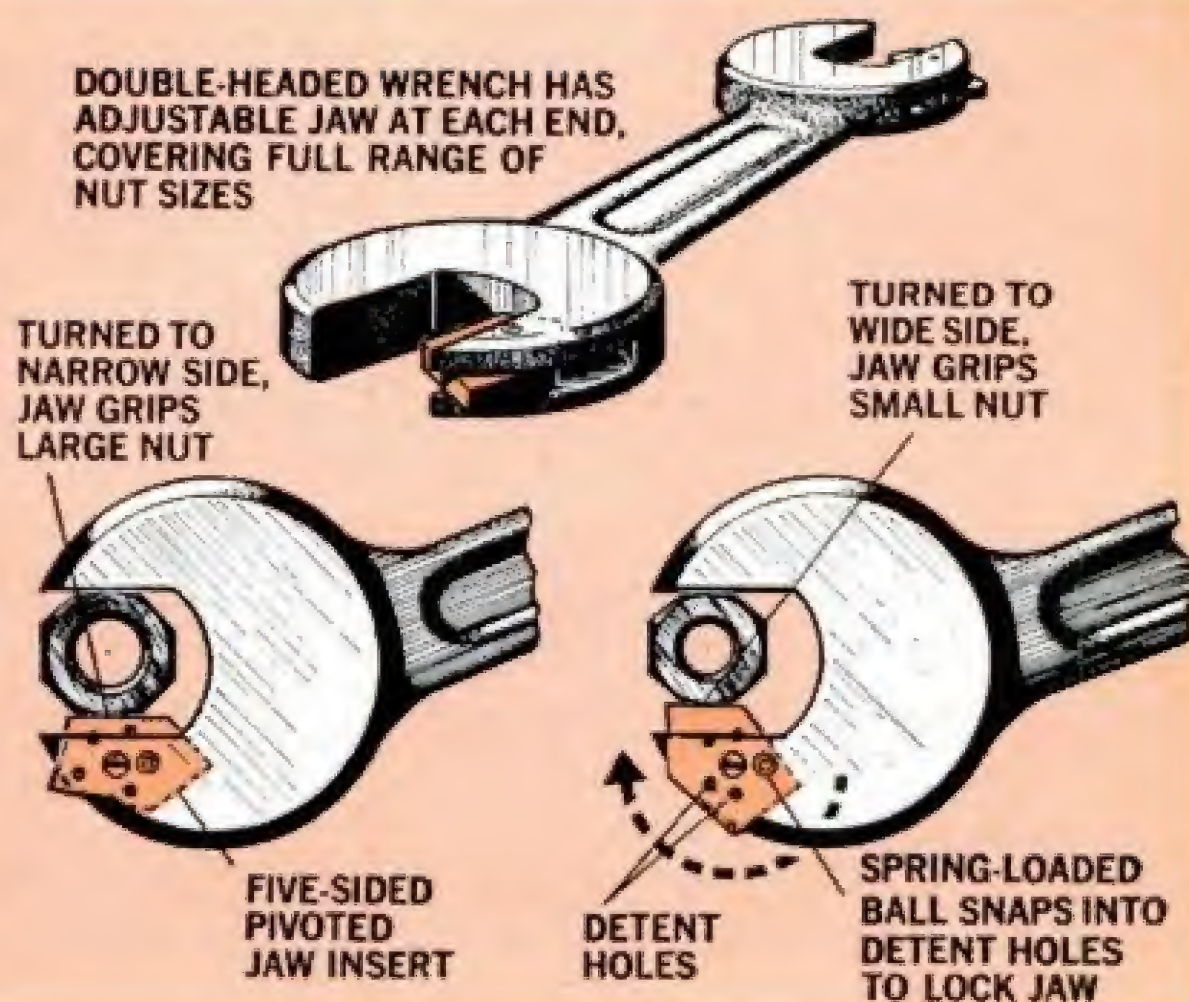


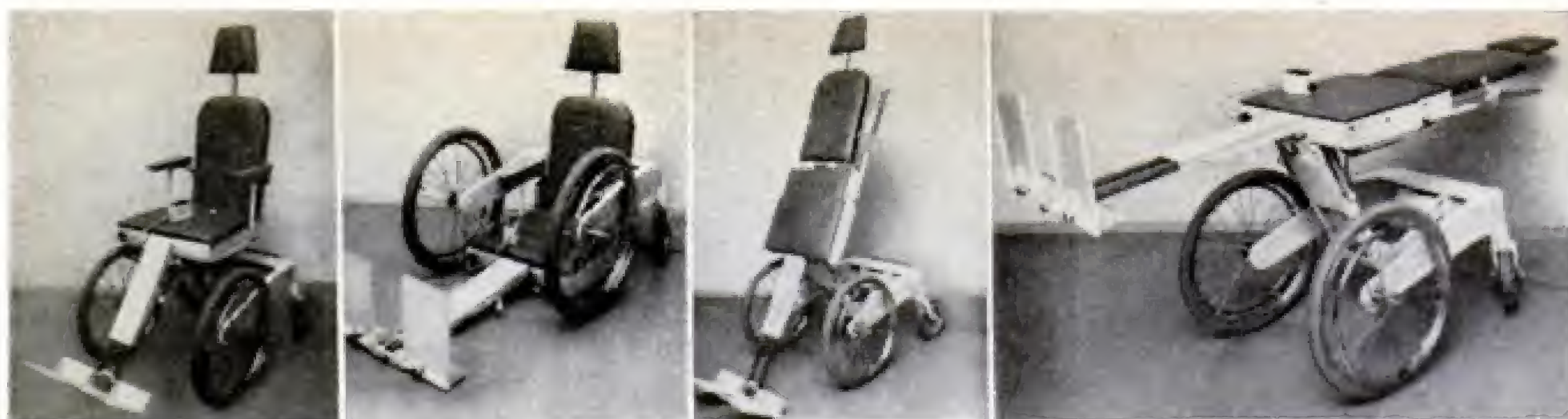
CAMP BED

CONVERTIBLE PAD for a station wagon can be used in three different ways. Invented by R. O. Dunaway of San Pedro, Calif., it has six hinged sections with one of them wedge-shaped. With the end sections folded up, it

makes a safe, cushioned play area for children. Folded as shown in the photo, it becomes an extra seat. Laid out flat, it's a mattress for sleeping with the wedge-shaped section at the end making a pillow.

ONE WRENCH does the jobs of a whole set with this adjustable open-end design. Turning a five-sided plate pivoted at the end gives you a choice of five different jaw openings. A similar rotating plate in the opposite end provides another series of openings so the wrench can handle 10 different nut sizes. A spring-loaded ball snaps into the appropriate detent hole to lock each plate at the desired setting. Inventor is R. D. Allred of Toledo, Ohio.



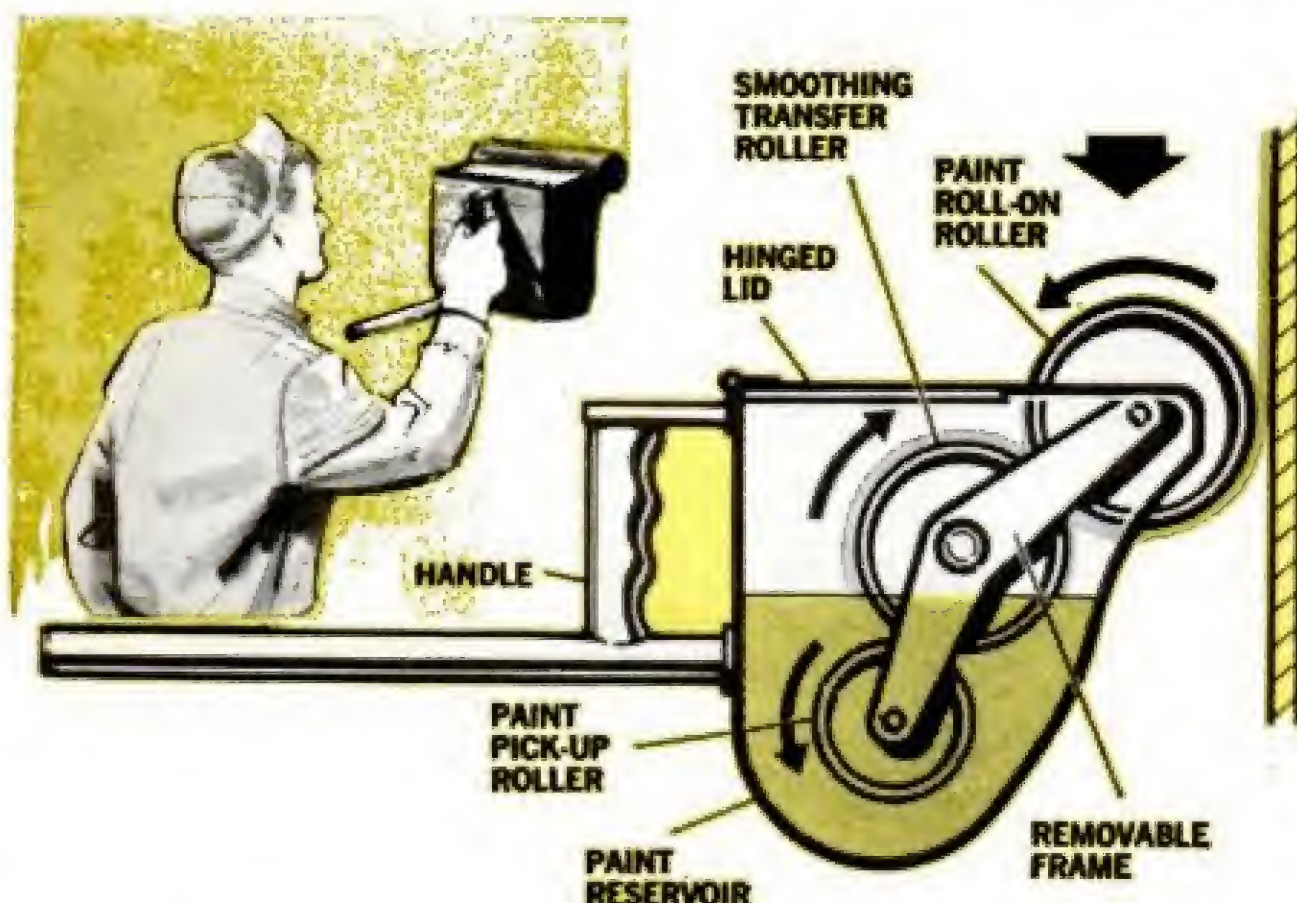


QUICK-CHANGE WHEELCHAIR turns itself into a variety of shapes to help handicapped persons maneuver more easily. Electrically controlled, it can squat to let its owner pick something off the floor or stand

up straight to make getting in and out simpler. It can also be straightened out flat for taking a snooze. The chair is the invention of the Redev Rehabilitation Development Co. of Helsingborg, Sweden.

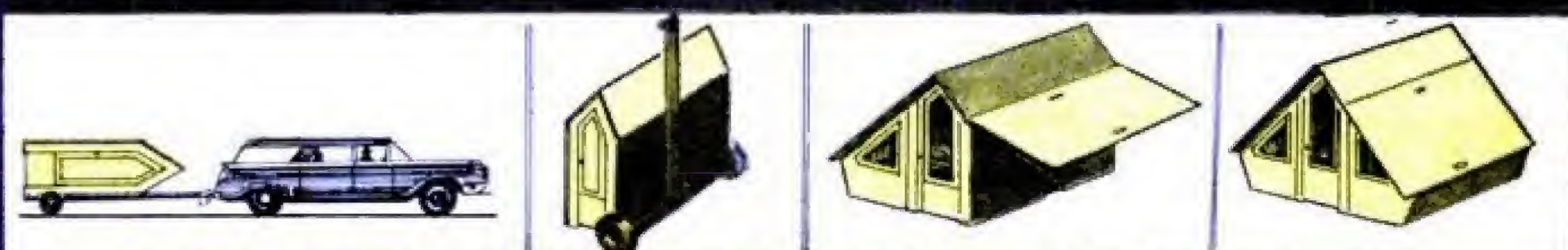
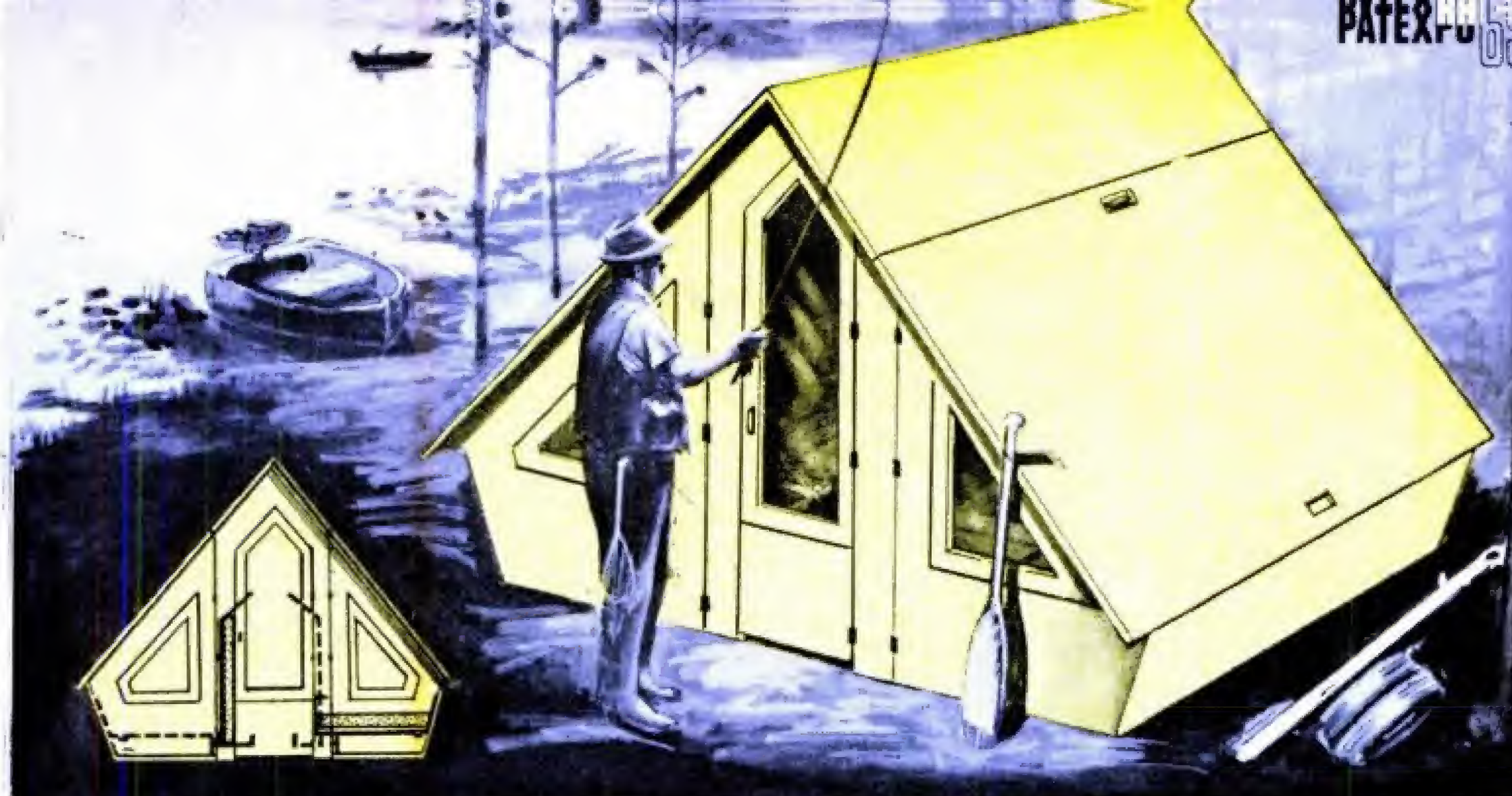


THREE-ARMED BOW lets you see your target clearly with nothing to get in the way. The Y-shaped design, invented by Raymond Gage of Dearborn Heights, Mich., also holds the arrow securely in the crotch.



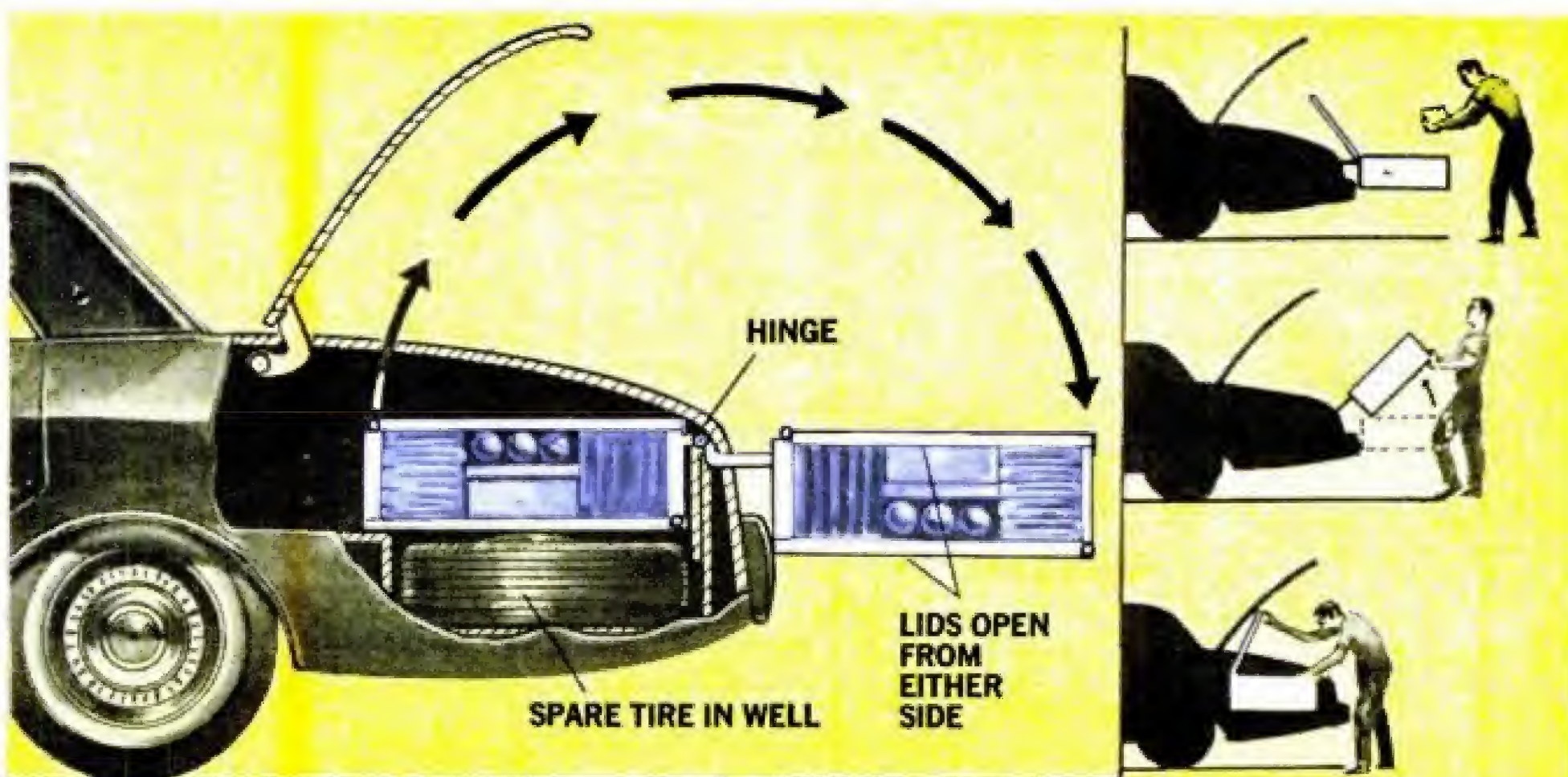
SELF-FEEDING PAINT ROLLER lets you cover a lot of area fast without stopping to refill it every few strokes. Paint is fed continuously from a reservoir by two lower rollers that pick it up and

smooth it out so just the right amount goes on the nap-covered top roller. The entire roller assembly is removable for cleaning. Elvin R. Munn of St. Louis, Mo., invented the work-saving device.



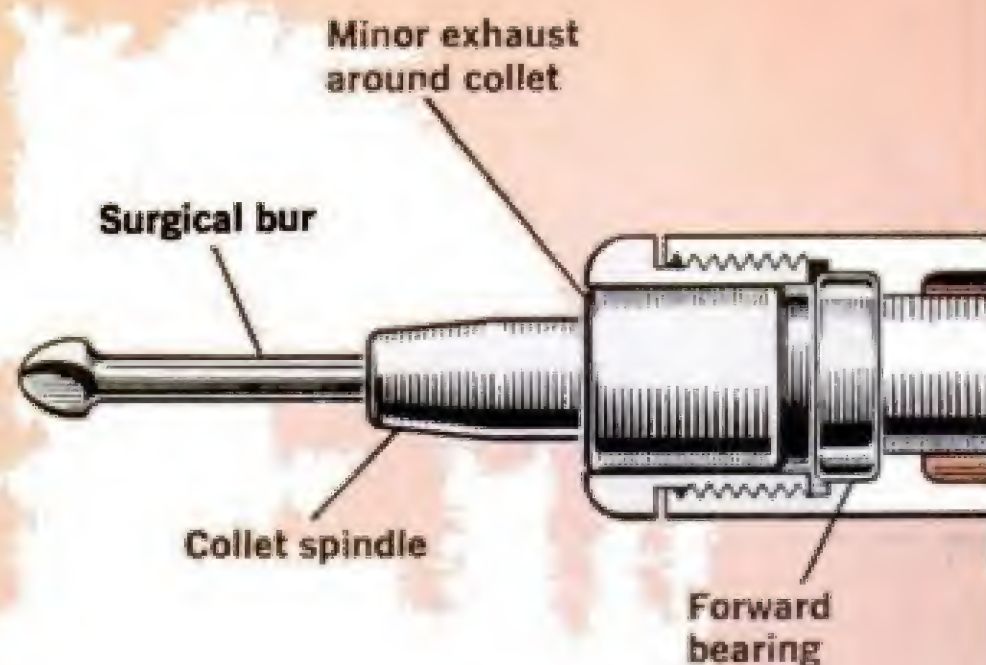
COLLAPSIBLE VACATION CABIN can be towed right along with you wherever you go. At the campsite, you stand the unit upright, remove the wheels and fold out hinged side panels to form a shelter for two. Cush-

ioned panels swing down inside to make seat-bunks. Invented by Henry Glass of Chicago, the sturdy metal structure is storm and animal-proof and can be left erected for use as a semipermanent weekend cabin.



SWING-OUT LUGGAGE CARRIER makes it easy to pack and unpack your car trunk and lets you get at the spare tire quickly if you need it on a trip. De-

signed by J. D. Fernicola of Centreville, Md., the hinged compartment has lids on both sides so you can reach the contents with the carrier in either position.



FINGER-TIP THROTTLE (left) gives surgeon precise control. Brake stops drill in two seconds

MECHANICS OF MEDICINE:

A 200-mph Surgical Drill, The Steady Beep of a Heart Monitor and an Electronic Voice Box

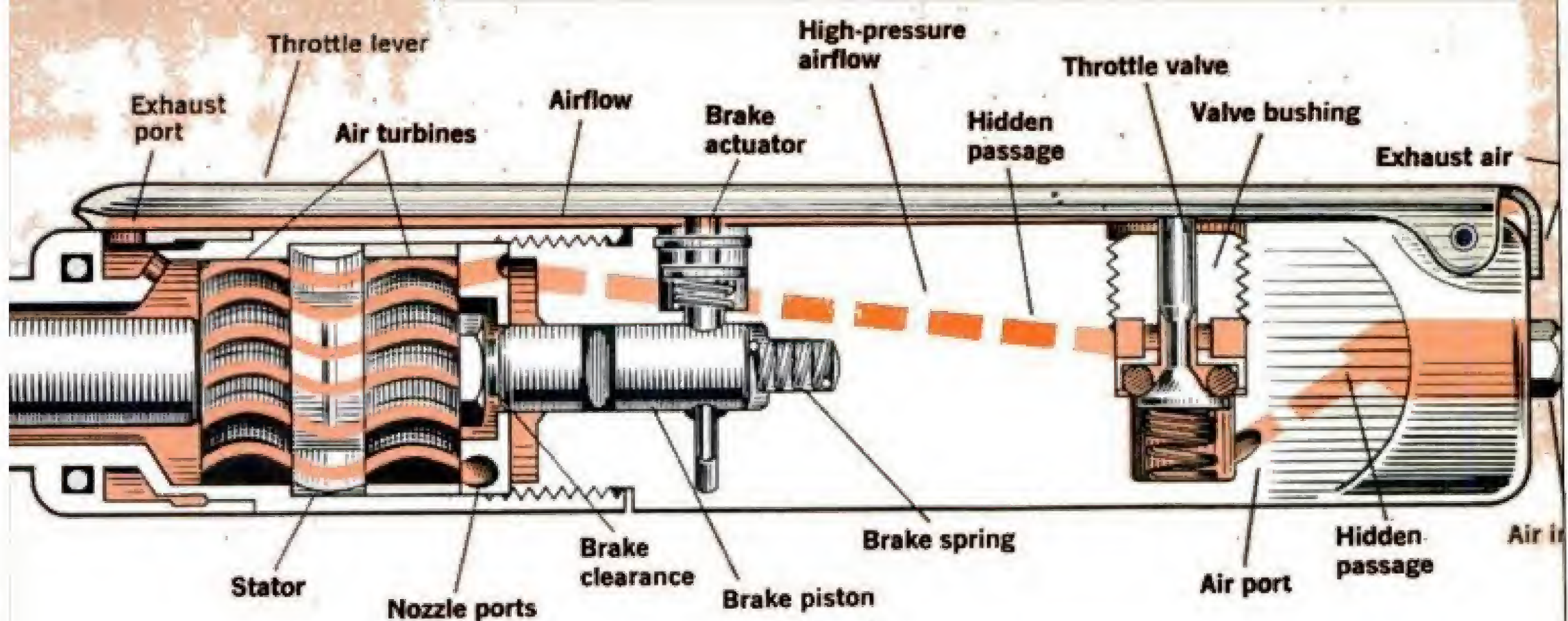
By ARTHUR FREESE

YOUR DENTIST'S high-speed drill has been converted to serious life-and-death business. In 1957, a young Pittsburgh oral surgeon traveled to a major dental convention in Chicago. There he saw a new high-speed air-driven dental drill—and a new technique of modern surgery had been born, for the instrument filled his thoughts all the way home. As Dr. Robert M. Hall told me—after buying one of these used drills the following year, he began to experiment with it, practicing on bones from an anatomy laboratory and on extracted teeth. He soon learned the dental drill was just that—a dental drill—and unsuitable even for oral surgery.

Hall began to move beyond dentistry

as he worked with the drill, finally turning to industry for parts he needed. He spent time and money devising a new air drill until he was no longer a dentist but an inventor, promoter, manufacturer and salesman, all in one. He located manufacturers to supply his air turbines—so tiny their bearings were the size of pinheads—some 50 separate parts are packed into his air drill which is little more than 5 inches long and $\frac{3}{4}$ of an inch in diameter; it weighs only 6 ounces.

The air drill is operated by a fingertip throttle at speeds of 100,000 rpm and has brakes that will stop it in one to two seconds. The air passes through the first turbine, then over a stator which redirects it through the second



HALL AIR DRILL directs air through turbine, then over stator which redirects it through a second turbine. This ups torque 80 percent, or 20 times that of dental air drill. Its tiny turbines whirl at 200 mph

turbine, increasing the torque some 80 percent. The combination gives the Hall Air Drill a torque some 20 times that of the dental air turbine high-speed drill; it can be sterilized repeatedly by autoclaving (heating in a moist atmosphere at 275°F. for a half hour) without damage; its tiny turbines whirl at 200 mph and a circular race containing a full set of their bearings is about the size of a bird shot.

Dry nitrogen is the best gas-power source and has to be 99.995-percent vaporfree, although breathing-grade compressed air of the same purity can also be used. The operating pressure is 90 to 110 psi. The air drill itself is of stainless steel and anodized aluminum with attachments of titanium and tubing of autoclavable neoprene. It utilizes drill burrs of high-speed steel, tungsten carbide and diamond, ground to tolerances up to 1/5000 inch.

The day of the hammer and chisel in bone surgery has passed—over 10,000 surgeons in more than 50 countries are now using the Hall Air Drill. Estimated to reduce surgery time as much as 80 percent, it's being used for more than 500 different operations, ranging from delicate sculpturing of heart valves and spinal bones to "wiping away" the bony growth of bunions.

With its speed, the burrs need only touch bone to take it off cleanly, without trauma. Bone grafts can be prepared with accuracy and precision, practically as a dentist does an inlay, using this instrument in place of the damaging hammer and chisel method, which necessarily produced only the roughest fit.

Healing is quicker and less painful, for the air drill can cut through bone

PRECISE CONTROL of Hall drill is demonstrated as it removes shell of egg without damaging membrane





BEDSIDE MONITOR for victims of heart disease keeps constant record of patient's heartbeat, blood pressure and respiration. Electrocardiogram is displayed on oscilloscope. Meter (at nurse's right) calculates heartbeats per minute. Movement of meter pointer above or below set limits automatically triggers an alarm. Audible "beep" signal also indicates the heart-beat rate and eliminates need for nurse to constantly watch the scope. Each patient in a modern hospital's coronary-care unit has a bedside monitor. Two electrodes that are attached to the body carry bioelectric stimuli to the monitor

CENTRAL STATION is slave unit that lets a nurse monitor four bedside units. By selecting a patient's channel, she can get waveform reading of heartbeat on the scope. Meters duplicate those on the bedside units. A red indicator button (top button next to each meter) lights when the heart rate exceeds preset limits of the meter. An audio alarm also signals this condition. Electrocardiogram recordings are made at the central station. When heart-rate alarm goes on, recording begins automatically, provides ECG for study by patient's doctor



or cartilage with the ease of a sharp scalpel slicing through soft tissue. Furthermore, there is little danger of injury to soft tissues which are simply pushed aside.

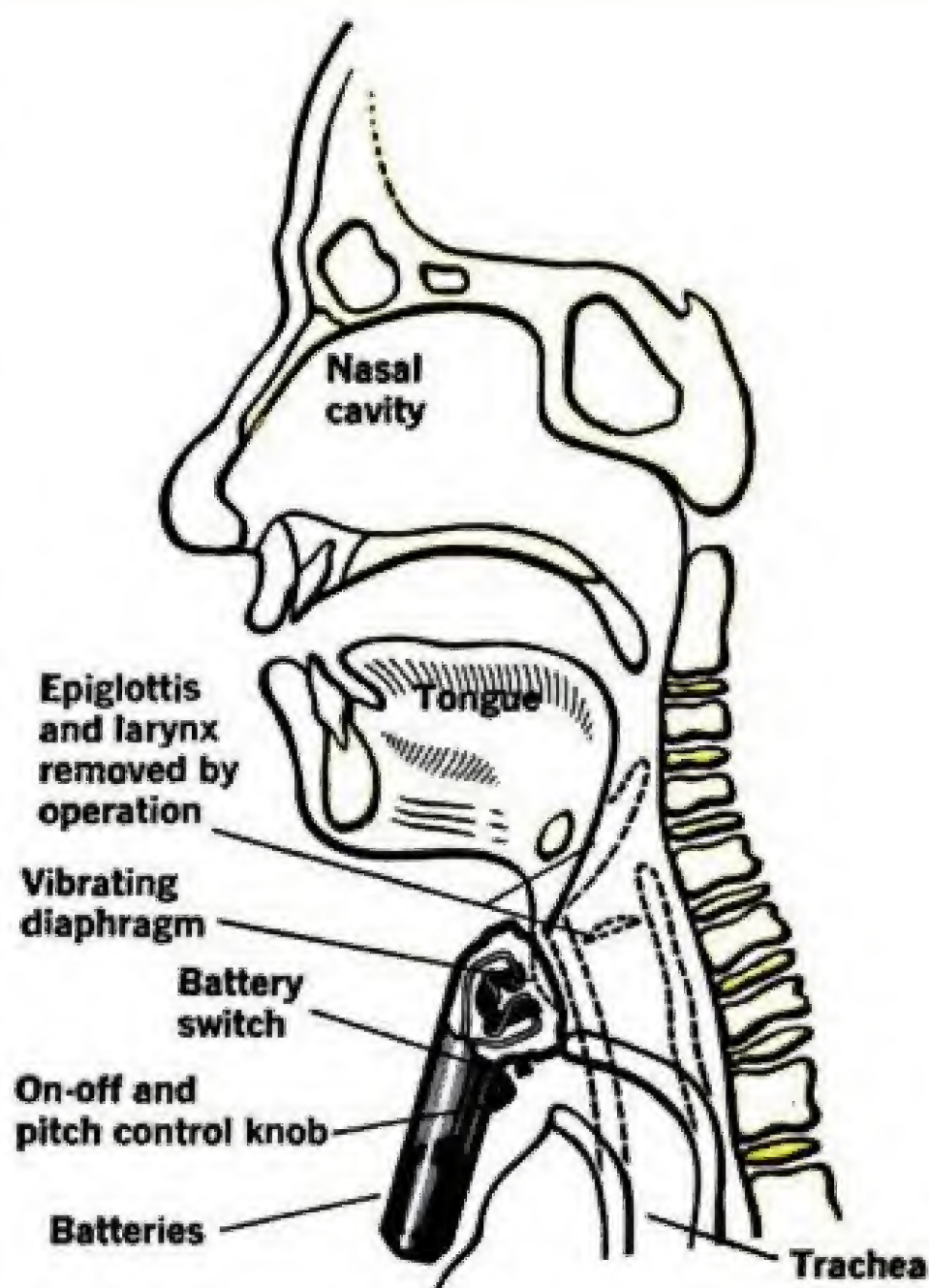
Coronary care unit

"I felt as if I were in the control room of a space ship to Mars." Elliott Gray spoke to me of a visit to his brother in a new type of lifesaving hospital facility. "There was this steady, eerie 'beep . . . beep . . . beep'; and those things that looked like space-age TV sets with orange-colored screens with moving lines dancing up and down all across their faces (there were six or seven other patients in the

room). Then my brother's lines suddenly jumped up and down as he laughed and I felt like calling for a nurse who seemed unconcerned and, barely glanced at the screens."

This was the coronary care unit (CCU) of a large modern hospital, the latest method of caring for the victims of heart attacks. This new facility permits closer scientific individual monitoring of numerous patients at the same time than the old-time nurse-by-the-bedside ever could achieve for her one patient. Modern electronics can even warn of trouble before it starts.

Fundamentally, the heart is nothing but a powerful, muscular pump. It stimulates itself to contract (beat) to



ELECTRONIC LARYNX is simple vibrating device that makes speech possible for those whose larynx has been removed (usually because of cancer.) Pressed against neck, the electrolarynx's vibrating diaphragm substitutes for the vibrations of vocal cords. Components (left) are vibrating transducer, mercury batteries and two transistors—an amplifier and an oscillator

squeeze the blood out into the vessels under sufficient pressure (blood pressure) to reach and supply the most remote body tissues. These bioelectric currents, produced when a muscle contracts, can be picked up by electrodes properly placed on special areas of the skin.

Monitoring systems pick up certain body functions (bioelectric stimuli, blood pressure, respiration rate and others) and convert them into electrical signals which are then processed electronically to produce a meaningful output on various display devices. This output can appear as an electrocardiogram wave, either on a sheet of paper in your doctor's office or the oscillo-

scope of the CCU, or the meter reading on Honeywell's new Patient Monitoring Unit, or as some form of alarm—a light or a sound. The orange screen shows the electrocardiogram. Blood pressure can also be shown as a waveform and recorded by inserting a catheter directly into an artery or vein, or even the heart itself, then converting the pressure energy into an electrical analog for electronic processing. Beeps occur each time the wave on the screen shoots upward—by measuring the number of these "blips" or sharp peaks per minute, Honeywell's monitor calculates the heartbeats per minute. This rate appears on an adjoining

(Please turn to page 206)

THIS IS THE YEAR of acquisitions. Many big names in the outdoor recreation business are entering the snowmobile market in grand style. Starcraft, big in boats and recreation vehicles, is in the business as is Glaston, now broadening its line after a hurried entry last year. Mercury is also firming up its product after a one-model start last year, and Wheel Horse has entered the field via its purchase of Sno-Flite.

Attesting to this snowballing market, recent figures show that 285,000 snowmobiles were sold last year.

It's a cinch more than that will be

sold in the year ahead. This is the year you can take advantage of new refinements in popular snowmobile lines. Prices are about the same as last year, so you'll get extra value for your dollar.

Ski-Doo this year has started a five-model "personality line." The smallest model, called the 12/3, is a full-sized machine with a 300-cc, 12-hp Rotax engine. It runs on a 15-in. track and has a suggested price of \$695. The next larger machine is the Olympique, what Ski-Doo calls the sporty machine with 15-in. track and an 18 or 24-hp engine. Suggested prices range from \$825 to \$945. Electric start is optional, starting

'70 A Sensational Year

**Big money, big names,
big technical improvements all go to
make them a big deal this fall**

By **DAN FALES**



SNO-JET has four new snowmobile series with 15 power choices from 12.5 to 35 hp. Prices go from \$699 to \$1349, plus freight from Quebec, Canada.

with the popular Nordic series. This 18-in. track machine comes with a 24 or 35-hp engine. The electric-start feature is standard on the higher horsepower model, which retails at a suggested \$1345.

The T'NT (Track and Trail) is the high-performance model on either 15 or 18-in. track. Engines range from 22 to 40-hp. Cost runs from \$875 to \$1345.

The Invader is Ski-Doo's big family or sportsman machine. This twin-15-in.-track snowmobile can climb through soft mountain snow and over difficult terrain. It has



SKI-DADDLER has a new series this year called the Mark models. This new AMF design is available in four models

Coming Up for Snowmobiles



ARCTIC CAT has eight models in its Panther line. Price runs from \$895 to \$1595, horsepower from 14 to 55, while 75 is available on a special order



JOHNSON'S SKEE-HORSE comes in two basic 25-hp models. This Light-Trac model sports a 15½-in. track while the Wide-Trac model has one of 20½-in.



SKI-DOO has 15 models in five series this year with horsepower running from 12 to 40. Prices go from \$695 to \$1645. Ski-Doo has race models, too



KIEKHAEFER MERCURY has seven models for '70 including this 25-hp machine with electric start. Other Merc snowmobiles include 22 and 20-hp models



EVINRUDE'S SKEETER is available in three types of machines, all with 25-hp engines. Track widths are either 15½ or 20½ in. Prices \$1025 to \$1395



WHEEL HORSE is just entering the snowmobile market with the six-model line called Safari. Wheel Horse bought the Canadian firm of Sno-Flite last April



MOTOR SKI, a subsidiary of Giffen Industries, is offering five snowmobiles in its 1970 line with a wide range of motors running from 298 to 634 cc

a 35-hp engine and costs about \$1645.

Ski-Doo also has the Blizzard—a limited-edition machine for registered racers only.

Adding four new models to its line, Kiekhaefer Mercury has seven models for 1970. The Mercury machines are available in three basic powers—25, 22

MASSEY-FERGUSON SKI WHIZ is available in three models with 18½, 22 and 29-hp engines. These machines are built with a very low center of gravity



and 20 hp. The 250 series has 437-cc, 25-hp Kiekhaefer engines with capacitor discharge ignition; comes with manual start as standard and electric start and reverse as optional. Machines have dual tuned exhaust systems with sealed mufflers and run on 17-in. tracks.

The Mercury 220 series has 399-cc, 22-hp Kiekhaefer engines with capacitor-discharge ignitions. Electric start and reverse are optional. This series is really the same as the 250 except for a lower horsepower engine and a sprocket reduction ratio of 13 to 29 instead of 16 to 29. The price is lower, too.

The Mercury 200, a smaller and less expensive version of other Mercury machines, has a 20-hp engine, 15½-in. track, 4½-in. ski width and a Salisbury variable-speed, torque-sensing clutch.

New designs of top Mercury models include six-inch-wide skis, four-leaf springs, redesigned rubber tread and direct reversing with no gearbox.

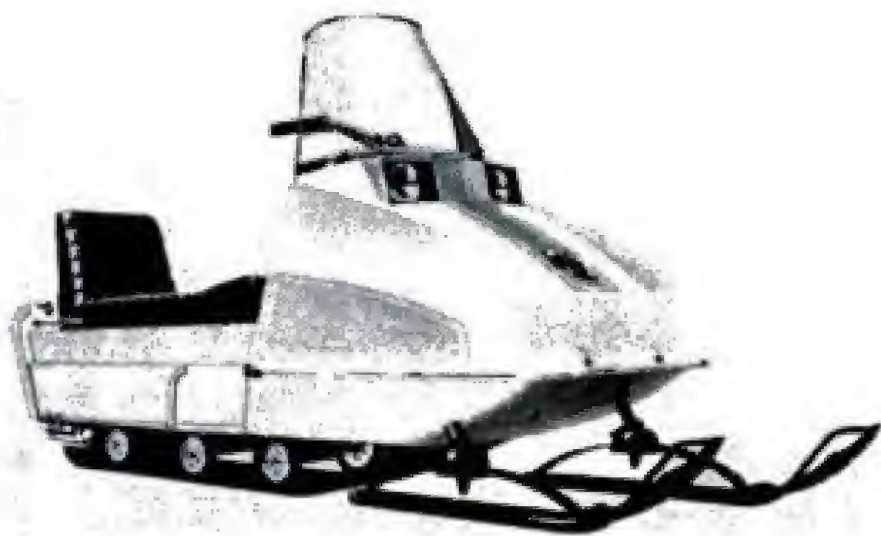
Wheel Horse entered the snowmobile

RUPP SNO-SPORT snowmobiles with aluminum chassis come in five engine classes ranging from 18 to 36 hp and with tracks either 15½ or 17½ in. wide





POLARIS, left, has 17 different types of snowmobiles this year. These go from the mini, 150-cc machine called Playmate up to the big 30-in.-track Voyager



FOX TRAC has 10 different snowmobile models which range in horsepower from 15.5 to 55. These machines are available on either 15 or 18-in. tracks

market with its purchase of the Sno-Flite snowmobile company last April. This famous power-equipment maker has named its machine Safari. Six models range from 295 to 440cc and from 18 to 30 hp. All have 15-in. tread except the 20-hp model with 22-in. tread. Prices are \$845 for the Safari 295 (18-hp); \$995 for Safari 309 (20-hp); \$1195 for the 309W (wide track); \$1065 for the 335 (23-hp); \$1125 for the 339 (26-hp); \$1195 for the 440 (30-hp).

Evinrude's snowmobiles for 1970 all
(Please turn to page 236)

YAMAHA is offering three basic snowmobile models. The machines have 24, 27 and 36-hp models with 15 and 18-in. tracks, cost from \$895 to \$1075



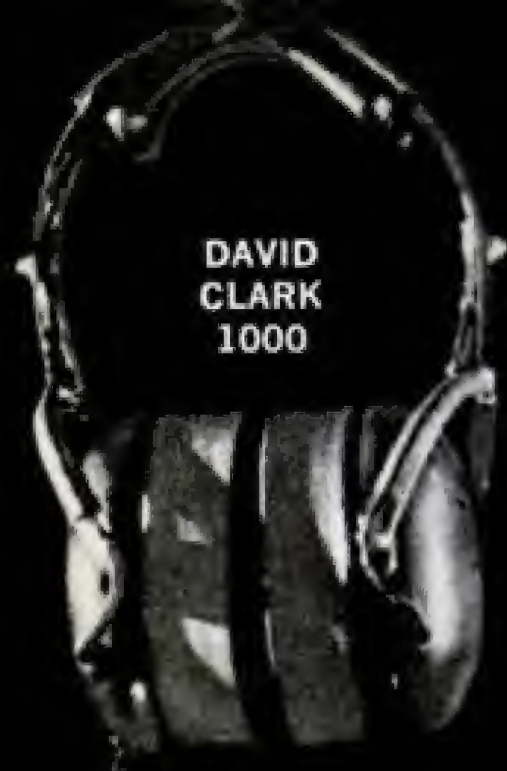
STARCRAFT, above, is entering the snowmobile business this year with nine models from 15 to 31 hp. Suggested prices run from \$750 to \$1260



ALLOUETTE has nine different machines available, running from the large 26-hp, 18-in.-track machine down to a more modest 14-hp, 15-in.-track version

SCORPION is presenting five models with 14 engine options in its new Mark series. Sizes of 275 to 800 cc are available. Tracks are 15, 18 and 28 inches

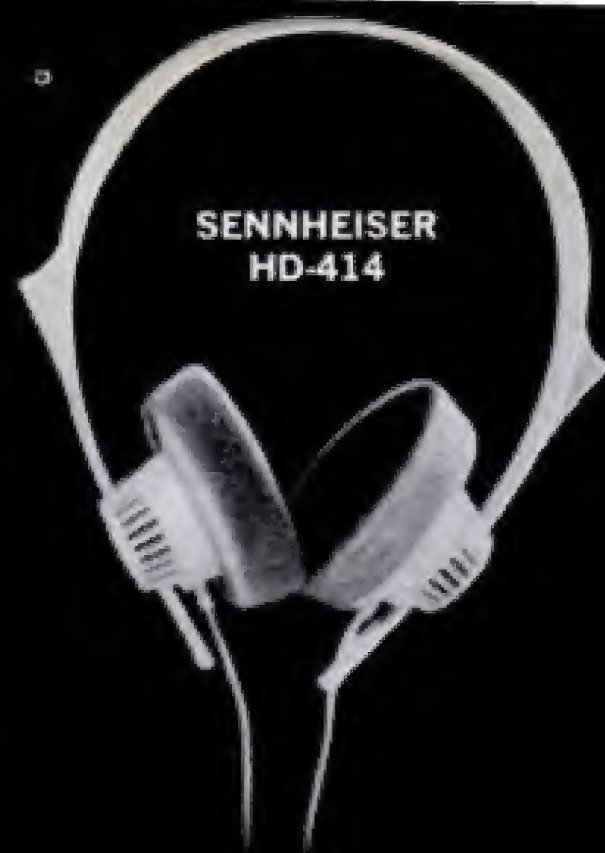




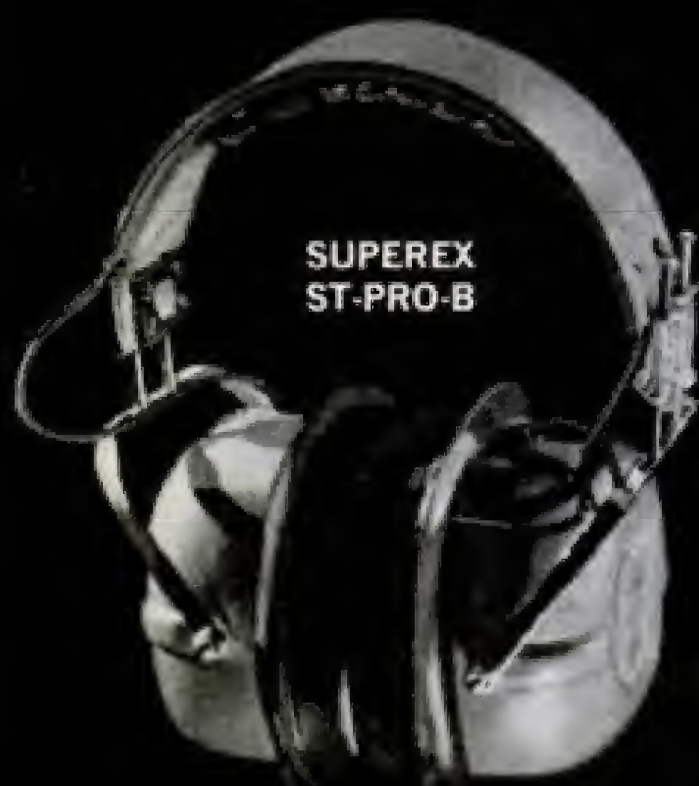
DAVID
CLARK
1000



DAVID
CLARK
300



SENNHEISER
HD-414



SUPEREX
ST-PRO-B

WIDE RANGE of stereo headphones gives you many types to choose from, all the way from under \$10 to almost \$100. Some of most popular models are shown on these pages. Prices are: Telex Encore, \$9.95; David Clark 300, \$19; AKG-Norelco K-20, \$19.95; Realistic Custom Pro, \$21.95; Koss K-6, \$26.50; Pioneer SE-30, \$29.95; Sennheiser HD-414, \$29.95; Superex ST-Pro-B, \$50; Clark 1000, \$85; and Koss ESP-6, \$95



REALISTIC
CUSTOM PRO



INDIVIDUAL VOLUME CONTROLS on some earphones let you adjust the sound level separately for each ear to provide a balanced stereo effect. Some models also incorporate tone controls. These Model H-876 headphones sell for \$19.95 from Allied

FOR TOPS IN HI-FI LISTENING:

Now It's Back

They went out with cat-whisker radios only to return as one of today's biggest-selling hi-fi accessories. Here's why they're back in style

By HANS FANTEL

Photos by Robert D. Borst

EARPHONES HAVE BEEN as extinct as dinosaurs for nearly half a century since the first loudspeakers made their appearance in the 1920s. Yet suddenly they're back in style. Sales are jumping so fast that many audio dealers consider them the hottest thing in hi-fi sound.

What accounts for the amazing revival of these

TELEX
ENCOREKOSS
K-6KOSS
ELECTRO-
STATIC
ESP-6AKG-
NORELCO
K-20PIONEER
SE-30

to Earphones Yet!

ancient relics? Basically, there are three reasons: They sound good, sell cheap and give you something hard to come by these days — instant privacy. Today's earphones — or headsets, as they're often called — are as different from their ancestors as modern solid-state stereo FM receivers are from early crystal radios. Earphones now rival the fidelity of the best loudspeakers, yet the price of a good pair is only a fraction of the cost of a good speaker. With many excellent models selling for around \$30 or less,

they offer fine sound at a real bargain.

As for instant privacy, just try it. Slip on a pair of earphones and you are whisked magically away from all the petty distractions of our bustling, noisy life. Gone is the rumble of the air conditioner or furnace, the clatter in the kitchen, the annoying chatter of someone talking on the telephone. You feel removed from the scene — alone with the music.

The privacy works both ways. It also makes life peaceful for others in your

home. You can crank up your Tijuana Brass loud and sassy without anybody yelling "Turn that darn thing down!" Great orchestral climaxes can roll out with their full vibrant power while everyone else is sleeping. The music is yours alone.

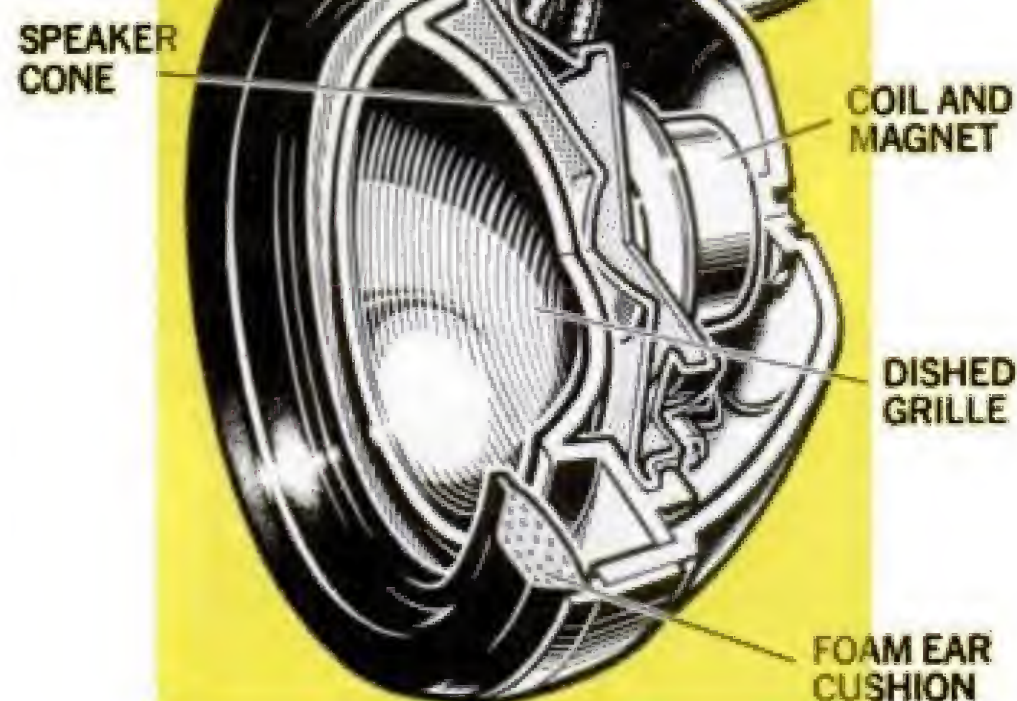
The first time you put on a stereo headset, it can be startling. Because the sound is piped directly to your ears, it skips the acoustic quirks of your living room. Problems like speaker placement and proper stereo listening location are automatically bypassed. The music reaches you exactly as it was recorded in the studio or concert hall. The effect is uncanny—you feel as if the whole concert stage is right in your head.

While you can use headphones for monaural listening, they are at their best on stereo recordings and broadcasts. Because each earpiece plays one stereo channel, the relationship between the two channels is always the same no matter where you sit or how you move around. The right channel is always on the right and the left on the left, and both sources are always the same distance from your ears.

Early earphones were nothing but primitive telephone receivers—and sounded that way. Today's designs are like miniature high-fidelity speakers. Each earpiece consists of a coil suspended in a magnetic field, connected to the output of the amplifier. The signal from the amplifier changes the magnetic attraction and repulsion between the coil and magnet, so the coil bounces back and forth in rhythm with the musical waveform. Attached to the coil is a plastic diaphragm—the cone—which pushes on the surrounding air to transmit audible sound vibrations to the ear.

The moving parts—coil and cone—must be carefully designed for minimum inertia. If they are sluggish to move, they can't keep up with the nearly 20,000 back-and-forth trips per second that spell out the top frequencies of the musical spectrum. A slow-moving cone would jiggle out of

CONVENTIONAL SINGLE-CONE EARPHONE

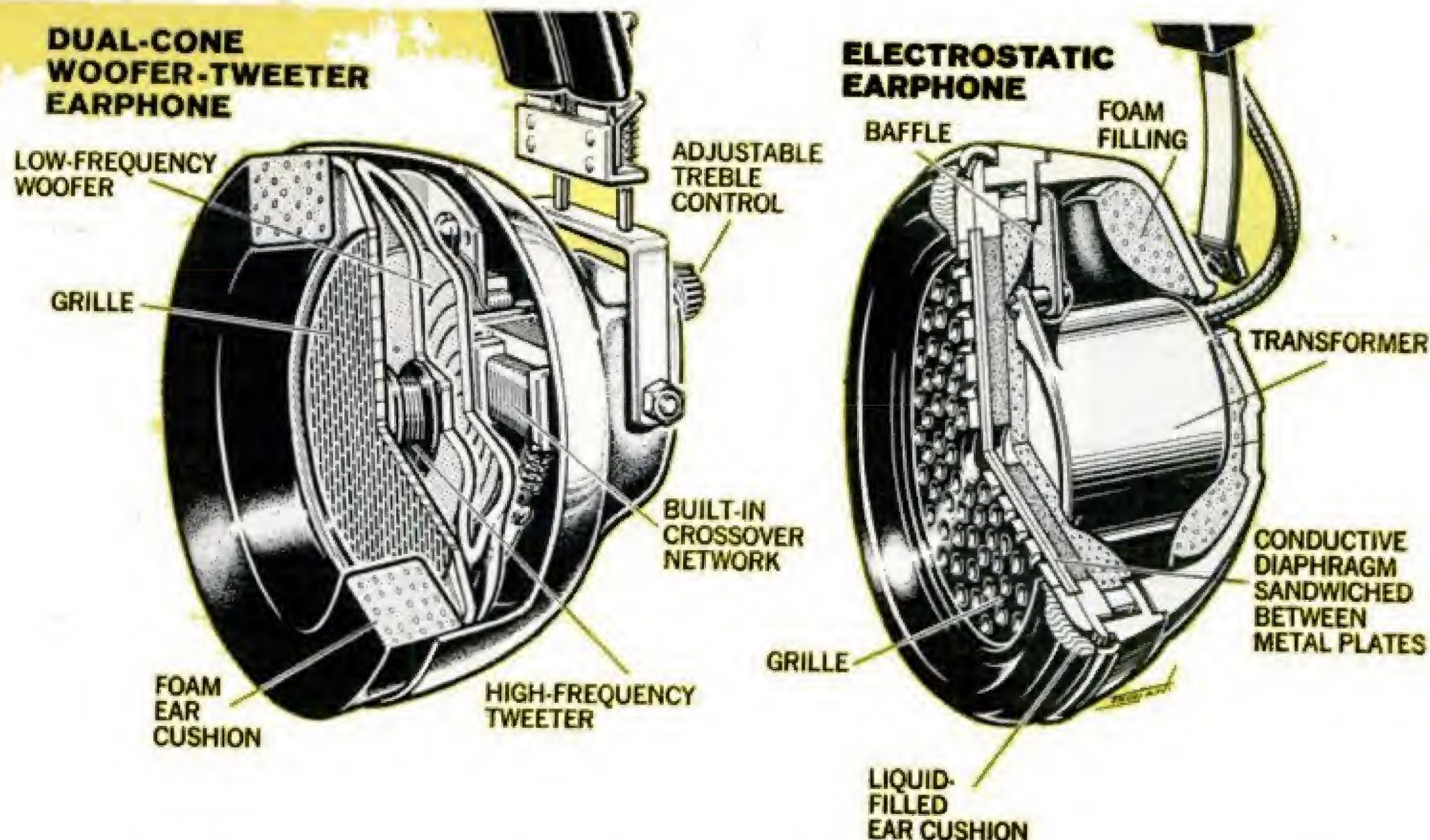


Technical Art by Peter Trojan



step with the musical waveforms and thus cause distortion. Moreover, the cone must be free from any resonance of its own. Otherwise, it might rattle like a window pane when a certain note is struck. Ideally, it should respond evenly to all the notes within the musical range.

While most earphones are similar in basic design, there are some interesting departures. Two manufacturers, Superex and Sharpe, put two separate coil-and-cone units into each earpiece in some of their models. One unit handles the low range; the other specializes in treble. The idea is to duplicate in earphones the separate functions



THREE BASIC TYPES of earphones are shown here. Most common is single-cone design on opposite page, consisting of a miniature coil-and-magnet speaker about 3 inches in diameter. Tiny speaker is able to deliver good sound because it feeds vibrations directly to ear and has to move only a small air volume. Dual-cone model above contains separate woofer and tweeter, designed to divide high and low frequencies for more efficient reproduction. Most radical departure is Koss's electrostatic design at right. Instead of a conventional coil and cone, it has a conductively coated plastic diaphragm stretched between two electrically charged metal plates. Diaphragm moves back and forth as the electrostatic attraction between the plates varies according to changes in the musical signal. This produces matching sound vibrations carried to the ear



that woofer and tweeter perform in loudspeakers.

One of the latest innovations in earphone design is an entirely new principle recently introduced by Koss. Instead of the magnet, coil and cone system, their Model ESP-6 has a thin, conductive diaphragm stretched between two electrically charged metal plates. Variations in the musical signal cause the diaphragm to be attracted first to one plate and then the other. It thus moves rapidly back and forth between the plates, creating sound vibrations that duplicate the musical signal.

Because the diaphragm is thin and light, it responds quickly and faithfully

to changes in the signal. Also, the driving force is applied evenly over its entire surface so it never flaps or buckles in its rapid reverses. That's why extremely low distortion is claimed for this unique design.

Competition is keen. Nearly a dozen manufacturers are now making high-quality stereo headsets, foremost among them Koss, Telex, Superex, Pioneer, AKG-Norelco, Clark, Sharpe and Sennheiser. Big mail-order houses like Allied, Lafayette and Radio Shack also market headsets under their own brand names. Prices range from \$9.95 for the Telex Encore up to \$95 for the Koss ESP-6 electrostatic model, with many

BUYING GUIDE TO STEREO HEADPHONES

MANUFACTURER	APPROX. PRICE RANGE OF MODELS	MANUFACTURERS' ADDRESSES
AKG-Norelco	\$19.95-\$39.95	North American Philips Co., 100 E. 42nd St., New York, N. Y. 10017
Allied Radio	\$11.95-\$34.50	Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680
Beyer	\$85.00*	Gotham Audio Corp., 2 W. 46th St., New York, N. Y. 10036
David Clark	\$19.00-\$85.00	David Clark, Inc., 300 Franklin St., Worcester, Mass. 01601
Jensen	\$24.95*	Jensen Mfg. Div., 5655 W. 73rd St., Chicago, Ill. 60638
Koss Electronics	\$24.95-\$95.00	Koss Electronics, Inc., 2277 N. 31st St., Milwaukee, Wis. 53208
Lafayette Radio	\$7.95-\$29.95	Lafayette Radio, 111 Jericho Turnpike, Syosset, N. Y. 11791
Pioneer Electronics	\$19.95-\$49.50	Pioneer Electronics, 140 Smith St., Farmingdale, N. Y. 11735
Realistic	\$11.95-\$21.95	Radio Shack, 730 Commonwealth Ave., Boston, Mass. 02215
Sennheiser Electronics	\$29.95*	Sennheiser Electronics Co., 500 Fifth Ave., New York, N. Y. 10036
Sharpe Instruments	\$19.95-\$100.00	Sharpe Instruments, Inc., 955 Maryvale Drive, Buffalo, N. Y. 14225
Sony/Superscope	\$27.50-\$29.50	Sony/Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif. 91352
Superex Electronics	\$19.95-\$50.00	Superex Electronics Corp., 4-6 Radford Place, Yonkers, N. Y. 10701
Telex	\$9.95-\$60.00	Telex Corp., 9600 Aldrich Ave. South, Minneapolis, Minn. 55420

*Only one model available.



CHAIRSIDE CONTROLS let you plug in headphones and adjust volume and balance without leaving your seat. Models above are (clockwise from lower left): Realistic, Superex, Koss T-5, Koss T-10, Allied and (at center) Heathkit. Other accessories are impedance-matching transformer (lower center) and dual-jack adapter cord



excellent models clustering in the \$20 to \$30 bracket.

Many listeners are amazed at the full bass obtained from earphones because of their extremely small size. Ordinary loudspeakers have to be fairly large for adequate bass response because they must push a large volume of air to project bass energy into a room-size listening space. But the "listening space" to be filled by earphones is only the tiny air volume between the phones and your eardrums. With earphones fitting snugly over the ears, this small air space is sealed off and represents what engineers call a "closed system." This provides a practically loss-free transfer of the low-frequency energy between earphone and eardrum—something like hollering down a tube. Under such conditions, a small sound generator can produce whumping big bass.

Just like loudspeakers, stereo headsets often have their own individual tone coloration. Some sound crisp and brilliant, others more mellow and velvety. Before you buy one for your own use, compare different makes and models just as if you were buying a pair of speakers. Clarity is the most important factor to judge by. Make sure the sound doesn't blur, even at full volume. Try to pick out the individual instruments in the or-

(Please turn to page 208)



The 'Shark' thrives on New York's trash piles

Without even a mild burp, the "Shark" recently demonstrated its ability to chew up such solid castoffs as old refrigerators, appliances and furniture. The \$25,000 German-built garbage truck was tested by the New York City Sanitation Dept.



In you go, head down

New automobiles may soon be shipped from the factory hanging nose down in a special rail car that saves space and speeds the job of loading and unloading. Developed jointly by General Motors and the Southern Pacific, the Vert-A-Pac car is designed especially for compacts that are short enough to be stood on end. The sides of the car swing down to form ramps. As each automobile rolls onto a ramp, its wheels drop into wells and hooks engage the underframe, automatically locking it in place. The ramp is then swung back up by a fork-lift truck. The vertical stacking arrangement accommodates 30 small automobiles compared to the 8 to 15 carried on a conventional rail transporter.



Husky road-and-railer

The Unimog, built by Mercedes-Benz, is a road and rail machine that can shunt 300-ton loads when it's on railroad tracks.



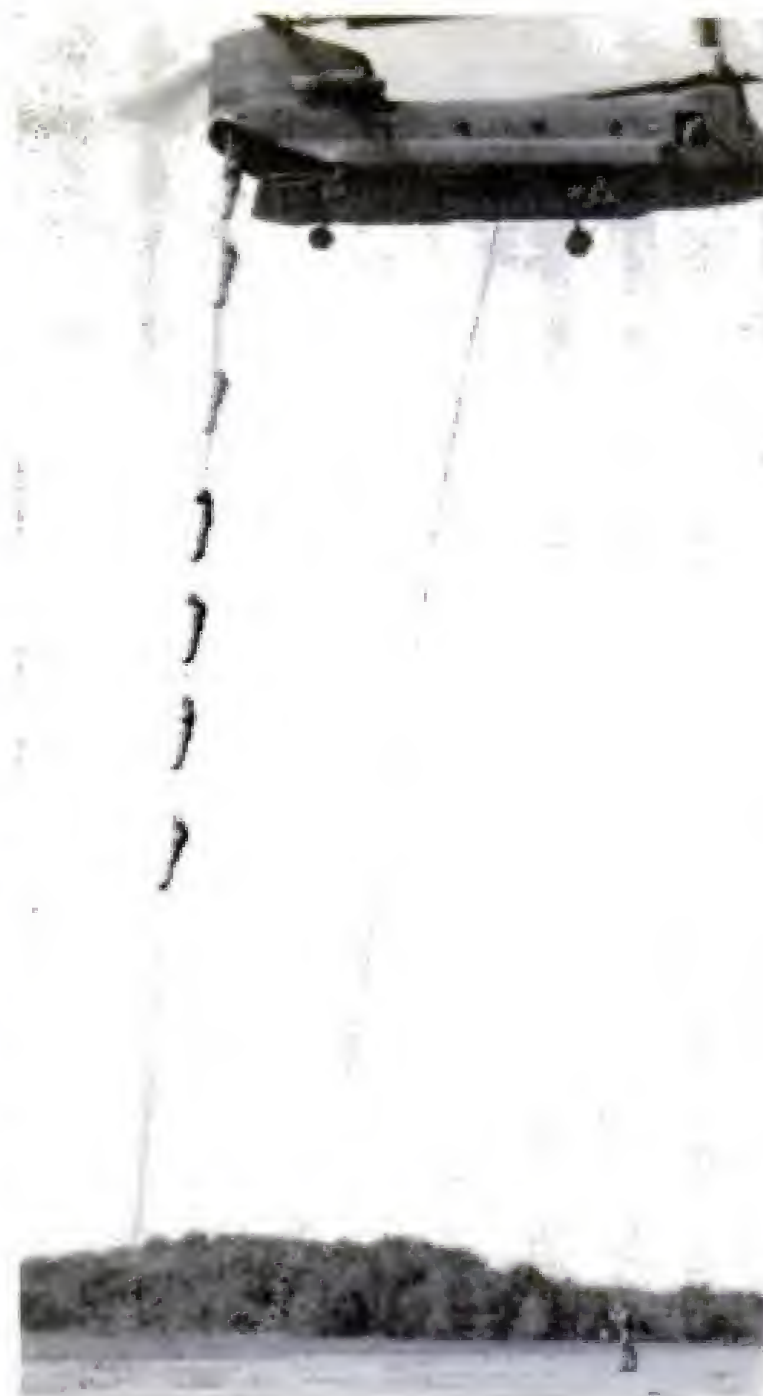
Buccaneer's halo

Humidity in the air caused this unusual cloud halo to form around a Royal Navy Buccaneer during a high-speed, low-level pass near the plane's carrier, the HMS Eagle.



Helicopter with an escalator

All that the passengers have to do is hold on in order to ride this "escalator to the sky." A powered ladder on the Chinook helicopter, moving five feet per second, can lift or lower 20 men in four minutes.



Mobile greenhouse

Walter Finch of England has found that his parked car, heated by the sun, is a perfect greenhouse for starting vegetables, flowers.



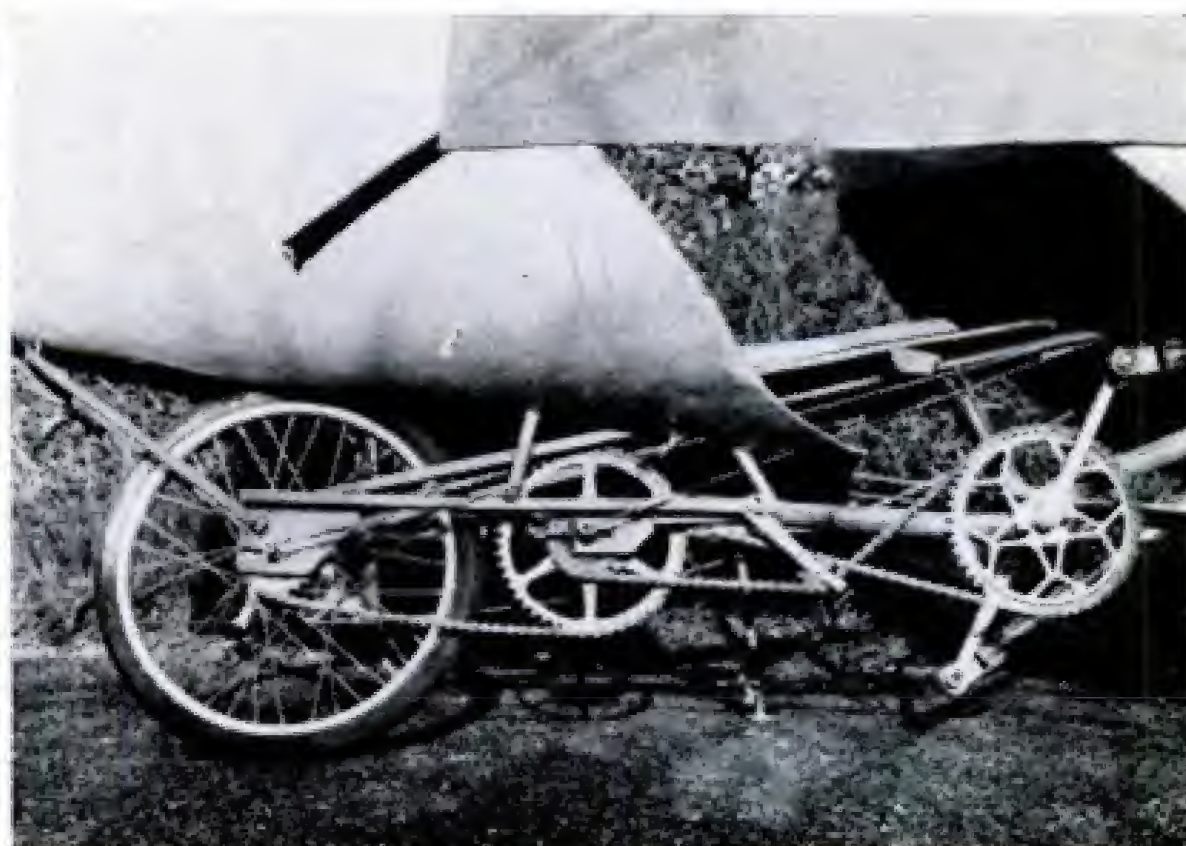
Lock-on parking ticket

Yokohama police make it impossible for a motorist to throw away a parking ticket. They lock it in place on his car.



Two-piece ship is welded together while afloat

Lacking space to assemble the 1066-foot-long *Melania*, the N.D.S.M. shipyard in Amsterdam built it in halves, floated the halves (upper left) and welded it together in the water (upper right). The tricky job of aligning the separate halves was accomplished by ballasting each of them, then adding a U-shaped "tunnel" under the hull to hold the alignment.



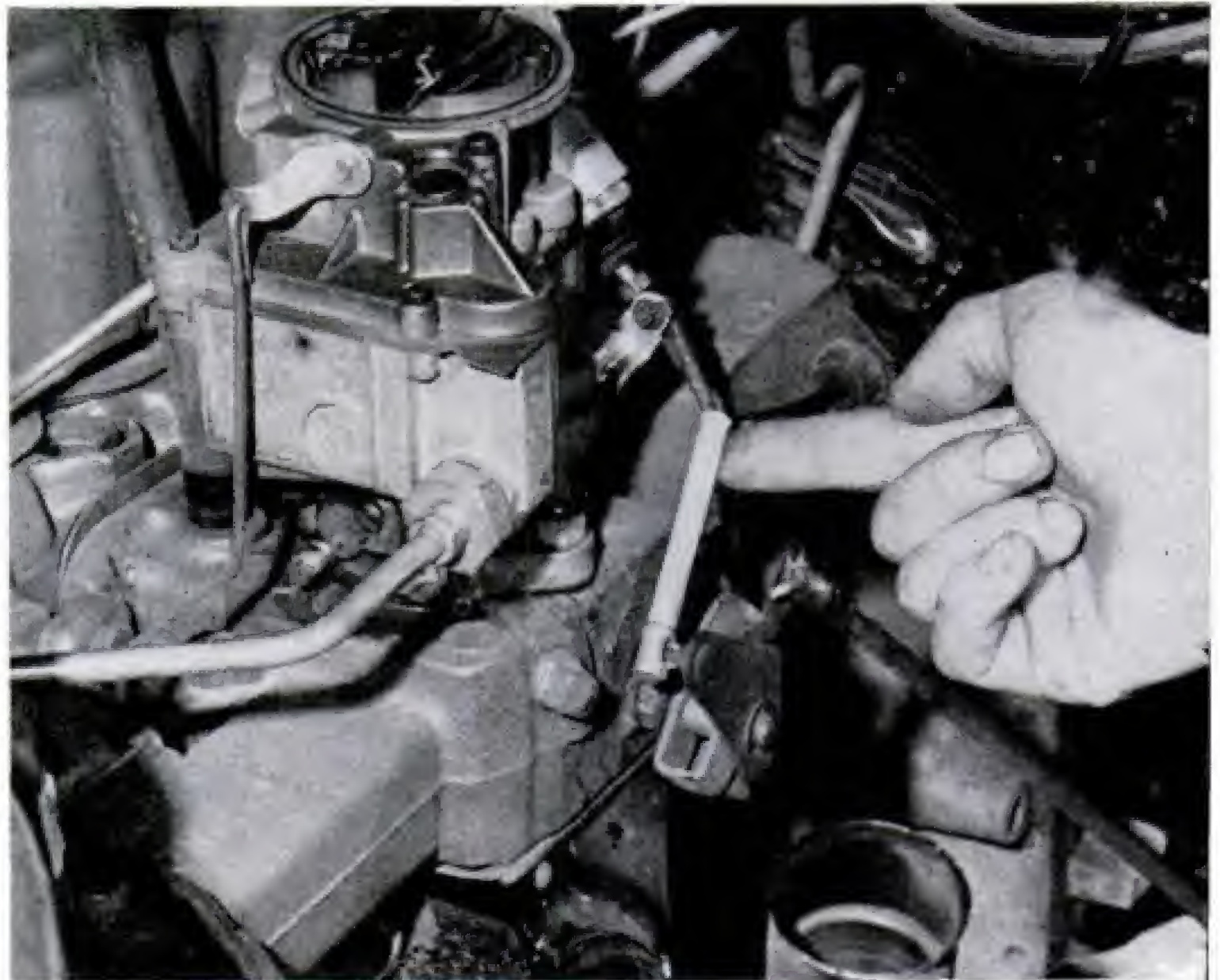
Speedy, two-wheeled egg

W. G. Lydiard, British aircraft engineer, has designed a plastic-enclosed bicycle that's driven 6 mph faster than standard bikes through a chain and pull-rod system.

HOW TO STOP A

When your engine continues running after you turn off the ignition, you have to follow a checklist that includes accurate timing and carburetor adjustments to stop it.

By MORT SCHULTZ



EXCESSIVE HEAT also contributes to dieseling. Periodic lubrication of the manifold-heat-control valve will keep it free and keep temperature down

EXCESSIVE FUEL getting into cylinders contributes to dieseling. Check that the linkage is not keeping the throttle plate open wider than it should be



MILLIONS OF OWNERS of '68 and '69 cars are asking why their engines keep running after they turn off the ignition. The condition, called after-running, dieseling, run-on or self-ignition, occurs when combustion-chamber temperature gets hot enough to ignite fuel which has flowed into the cylinders.

Dieseling is common in newer cars because of the calibrations that have to be maintained with new anti-air-pollution hardware. Exhaust-emission systems require strict compliance with tight idle-speed and ignition-timing adjustments. Unfortunately, a slight variation from specs results in a situation conducive to dieseling.

Late-model engines operate on lean

DIESELING ENGINE

fuel mixtures so automakers can keep noxious emissions within allowable limits. A lean mixture contributes to rough idling. To prevent it, the "curb" idle speed has to be set pretty high—600 to 700 rpm is normal in '68 and '69 cars.

Don't confuse curb-idle speed with fast-idle speed. The latter is the idle setting for a cold engine with the choke closed. The fast-idle screw is positioned on the high step of the fast-idle cam to allow faster warmup. The specification is about double the curb-idle speed, which is idle rpm with the engine warm and choke open.

However, a curb-idle rpm of 600 to 700 is high. To permit it, the carburetor throttle plate is open fairly wide. This gives fuel more of a chance to flow through the carburetor idle system and into the cylinders. Dieseling occurs when the engine's shut off and this raw fuel is ignited inside the cylinders.

No spark is needed to ignite this fuel. Cylinder temperatures are high enough to do it: A lean fuel mixture burns faster than a rich fuel mixture. To compensate for this, ignition timing of 1968 and 1969 cars has been retarded more than ever, and burning of the fuel mixture proceeds well into the power stroke. Since the fuel mixture burns late, the removal of combustion-chamber heat through the exhaust stream is also retarded, and temperatures get hot enough inside cylinders to cause after-running.

To control dieseling, either the fuel flow into the cylinders or the heat (or both) has to be kept at a pitch where it can do no harm. The throttle-plate setting and the adjustment of ignition timing play the most significant roles. However, there are other factors to consider.

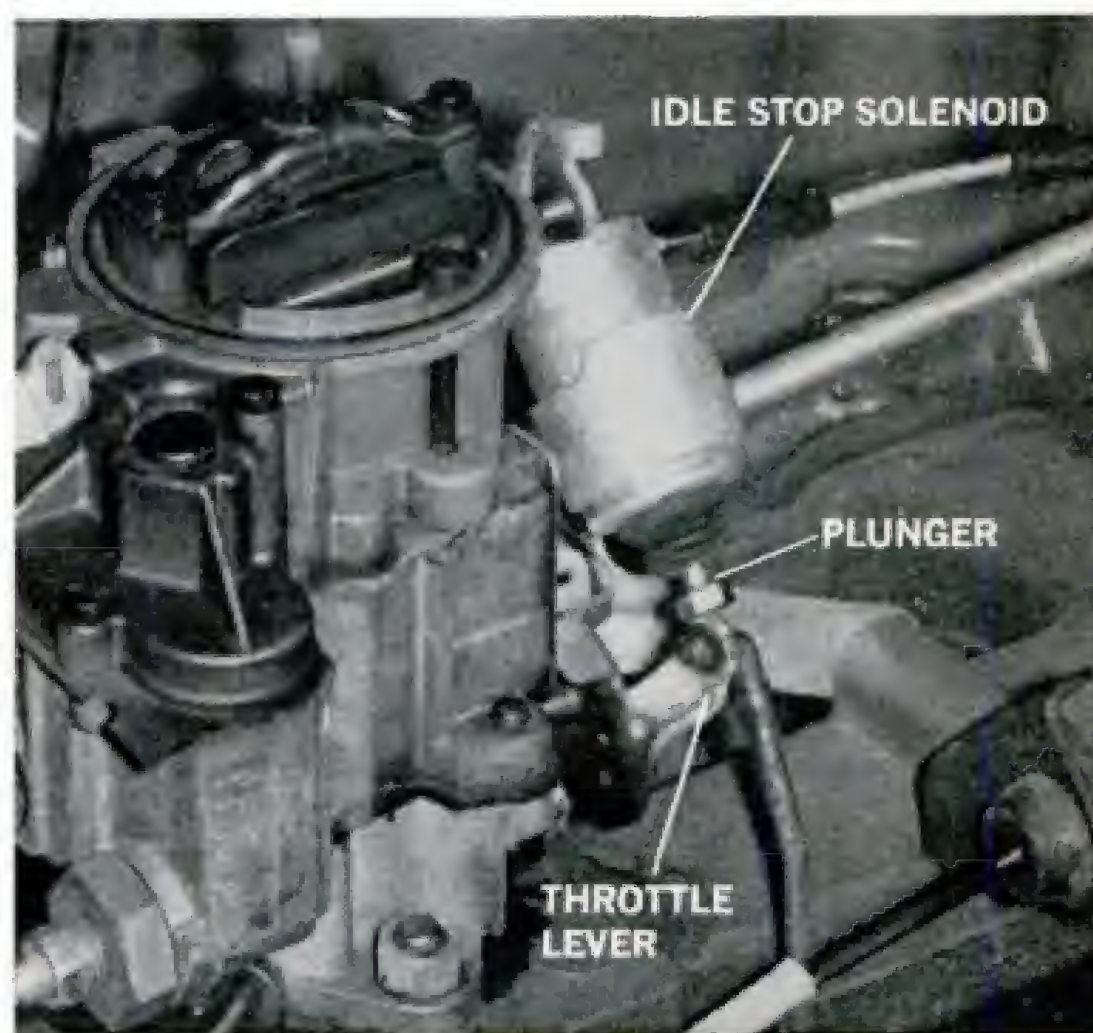
For example, if you keep your foot on the gas pedal as you turn off the ignition, you contribute to dieseling by keeping the throttle plate open more than it should be.

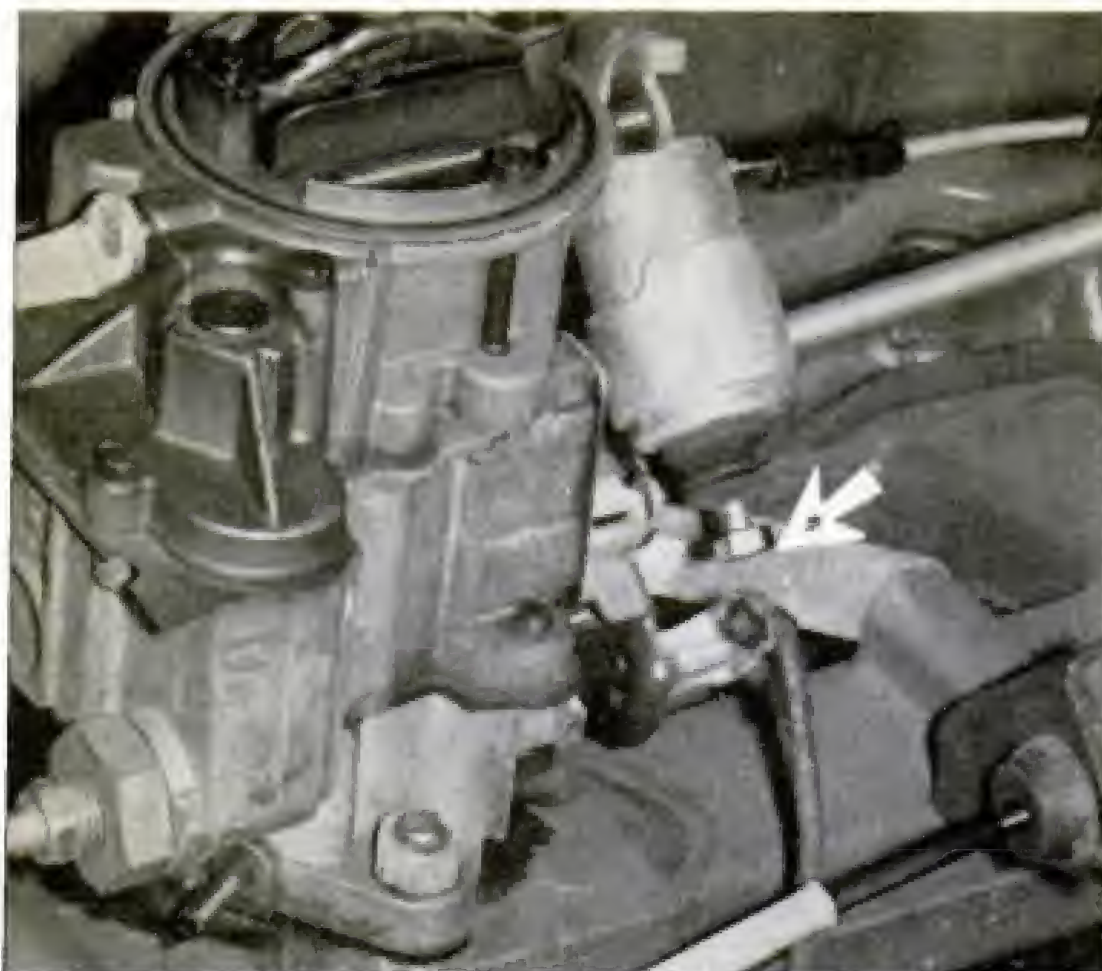
An obstruction might be holding the



CARBURETOR ADJUSTMENTS include fast-idle setting that's right on specification. Turn the fast-idle screw until tachometer reads the correct engine rpm

IDLE-STOP SOLENOID on some newer cars operates a plunger that retracts to allow the complete closing of the throttle when the ignition is turned off





PLUNGER of the idle-stop solenoid remains in a fixed position just as long as the engine is running. Throttle linkage only comes in contact at idle

throttle plate open. Check that the throttle linkage is not binding or damaged.

Check the manifold-heat-control valve. If it is stuck, hot exhaust gases will be trapped and engine temperature will rise. Find this valve beneath the exhaust manifold and test its operation by jiggling the counterweight. If the valve is stuck, tap it with a hammer and lubricate with manifold-heat-control-valve lubricant. If the valve can't be freed, replace it.

As mentioned, what you have to do most times to stop dieseling is to assure correct curb-idle speed and proper ignition timing. Check these when dieseling occurs and set to specifications given in the manual. On most 1968 and 1969 cars, these specs are also on a label attached to the top of the radiator or grille.

In setting curb-idle speed, note that the idle-mixture adjusting screws on your carburetor probably have plastic caps on them. These caps (one if you have a one-barrel carburetor) control richness of fuel mixture by limiting travel of the screws.

Although specifications vary from car to car, the curb-idle adjustment is pretty much the same. Warm up the engine to normal operating temperature, making sure that the choke is released. Cars with manual transmission are placed in neutral; those with automatic transmissions, in drive. Set the handbrake firmly.

Hook up an engine tachometer and turn the idle-speed screw until you get the rpm reading for your engine. Turn



IDLE SPEED of engine equipped with idle-stop solenoid is adjusted by turning the plunger against or away from the throttle linkage to get right rpm

the idle mixture screw until the tachometer shows the highest rpm you can get.

Now, skip back to the idle-speed screw and readjust until the tach again shows the correct rpm reading for your engine.

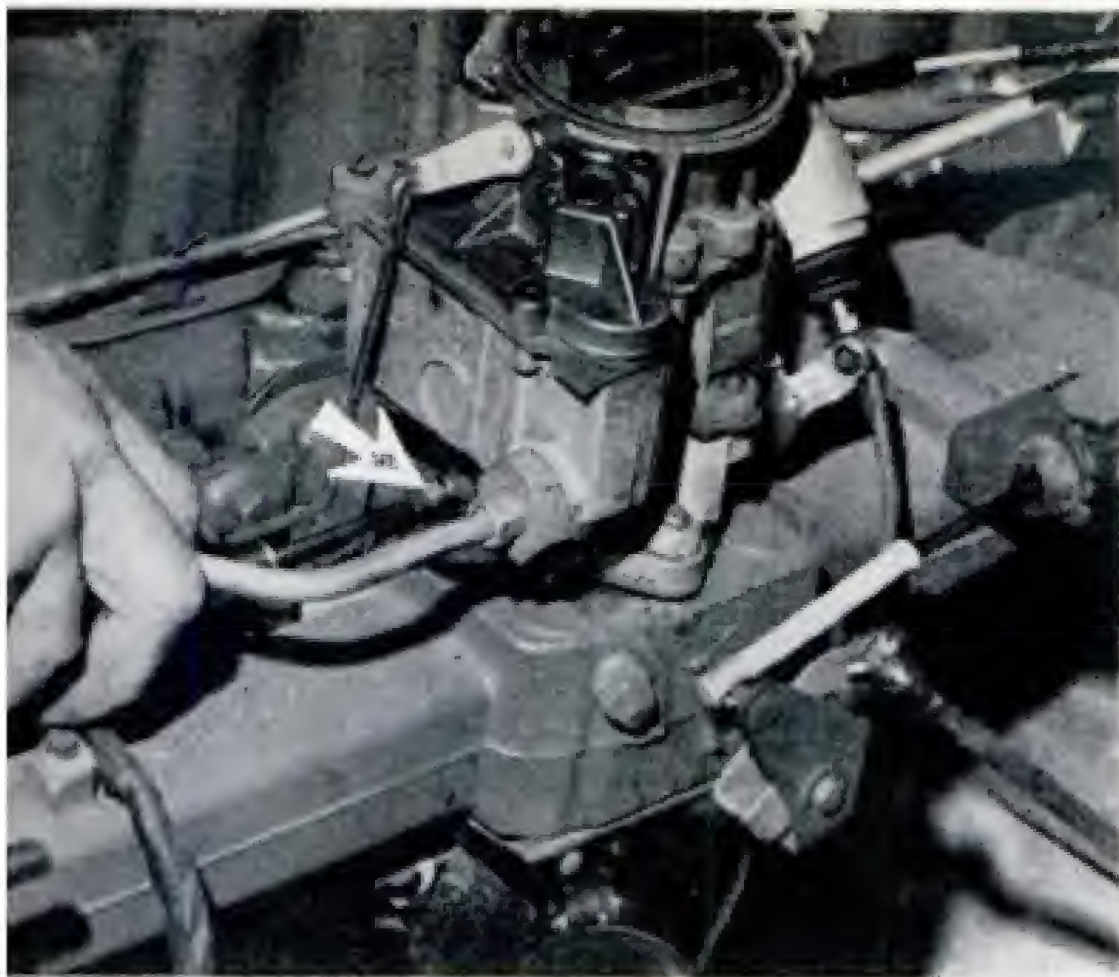
If you're lucky, you will have an innovation on your carburetor known as an idle-stop solenoid. This provides for immediate and full closing of the throttle valve as soon as the ignition is shut off.

Automakers claim after-running will not occur if idle speed and timing are kept properly adjusted. However, this solenoid assures that dieseling won't occur even if they do go out of adjustment.

In operation, the plunger of the idle-stop solenoid holds itself against the throttle-plate lever while the engine idles. This keeps the throttle valve open. But as soon as ignition is turned off, cutting current to the solenoid, the plunger retracts and the throttle valve snaps shut.

Checking the function of the idle-stop solenoid is easy. Warm up the engine and let it idle. Look at the solenoid's plunger. It should be resting against the throttle-plate lever. Now, shut the engine off and watch the plunger. You should see it retract to allow the throttle valve to close. Failure of the plunger to act this way means that the solenoid is defective. There is no idle adjusting screw on a carburetor that has an idle-stop solenoid. Idle is set by adjusting the position of the solenoid plunger.

Idle the engine and turn the plunger



IDLE-MIXTURE SCREW on carburetor is adjusted as part of curb-idle speed setting. Newer cars have a built-in stop to prevent too rich an adjustment

until the tachometer records the curb-idle rpm specification for your engine. Other than this, setting idle on your car is done the same as described before.

Timing—that other critical adjustment—is done with a timing light. Disconnect the spark-advance unit vacuum line and run the engine at idle.

Timed pulses of the timing light will make the timing mark on the crankshaft pulley or vibration damper appear stationary if the correct mark is in alignment with the pointer. If the mark is not aligned, loosen the distributor and turn it against rotor rotation to retard timing. Tighten the distributor housing and recheck.

If dieseling should strike your engine, you should stop it immediately to prevent undue strain on parts. If the car's equipped with a manual transmission, "stall" the engine by engaging the brake, and releasing the clutch. If the car has an automatic transmission, engage the brake and put the transmission selector lever into drive.

Dieseling, incidentally, is not the same as detonation or preignition. These are far more serious, since either can ruin pistons and rings.

Detonation is the uncontrolled burning of the fuel mixture at the time of or immediately after ignition. Combustion is so rapid that rising pressure causes shock waves to reverberate through the cylinder and they produce an audible noise.



ENGINE TIMING with exhaust emission controls must be accurate. Timing light, shown here aimed down at timing marks on pulley, gives best reading

Detonation results from using a poor grade of fuel, having the carburetor set for an excessively lean fuel mixture and having ignition timing overadvanced. If switching gasolines, and adjusting timing and carburetion don't help, the cause is carbon particles on a piston or the cylinder head. They produce "hot" spots which are igniting the fuel. A carbon-and-valve job is the solution.

Preignition is igniting of the fuel mixture before normal ignition takes place. This occurs when the piston is still in its compression stroke. It causes extremely high combustion chamber temperatures—in fact, hot enough to burn a hole right in the top of a piston.

Preignition is caused by combustion chamber deposits, combustion chamber "hot" spots resulting from poor heat dissipation by the surrounding cooling jackets and use of wrong heat-range spark-plugs.

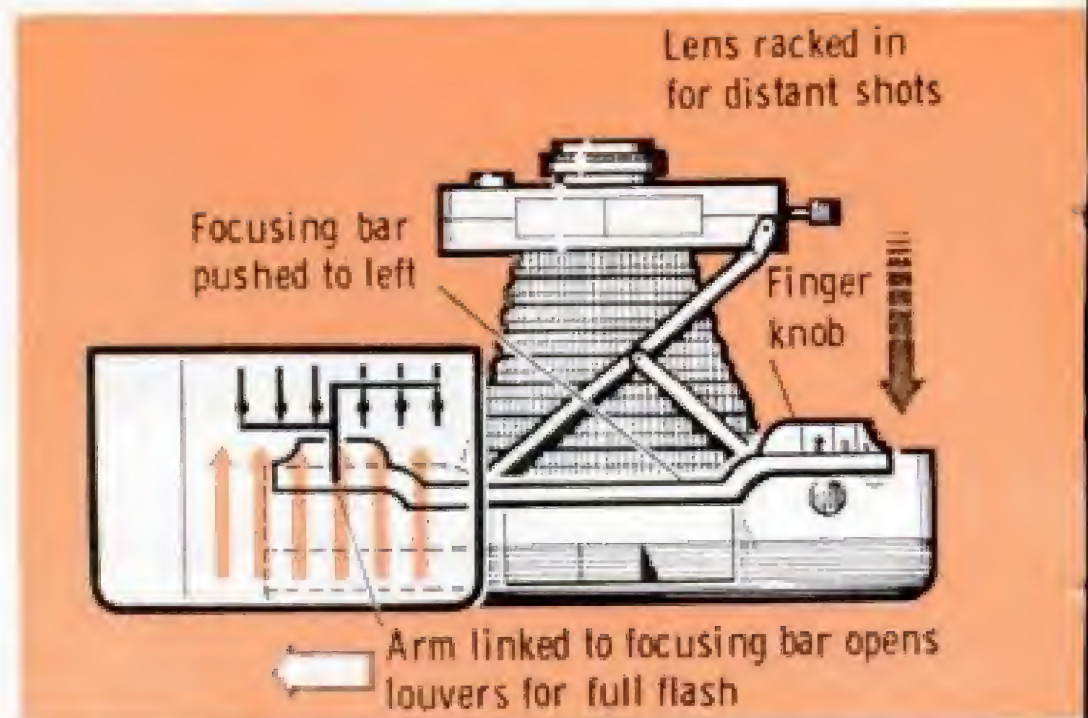
Preignition, like detonation, causes engine knock or ping. However, it's difficult to tell which one is causing the noise. For this reason, the procedure to follow when you start hearing noise from inside the engine should be the same:

- Switch to a better grade of gas, and set carburetion and ignition timing.
- Check sparkplug condition and the heat range.
- If the condition doesn't clear up, clean out the engine deposits by doing a carbon-and-valve job. ★★★

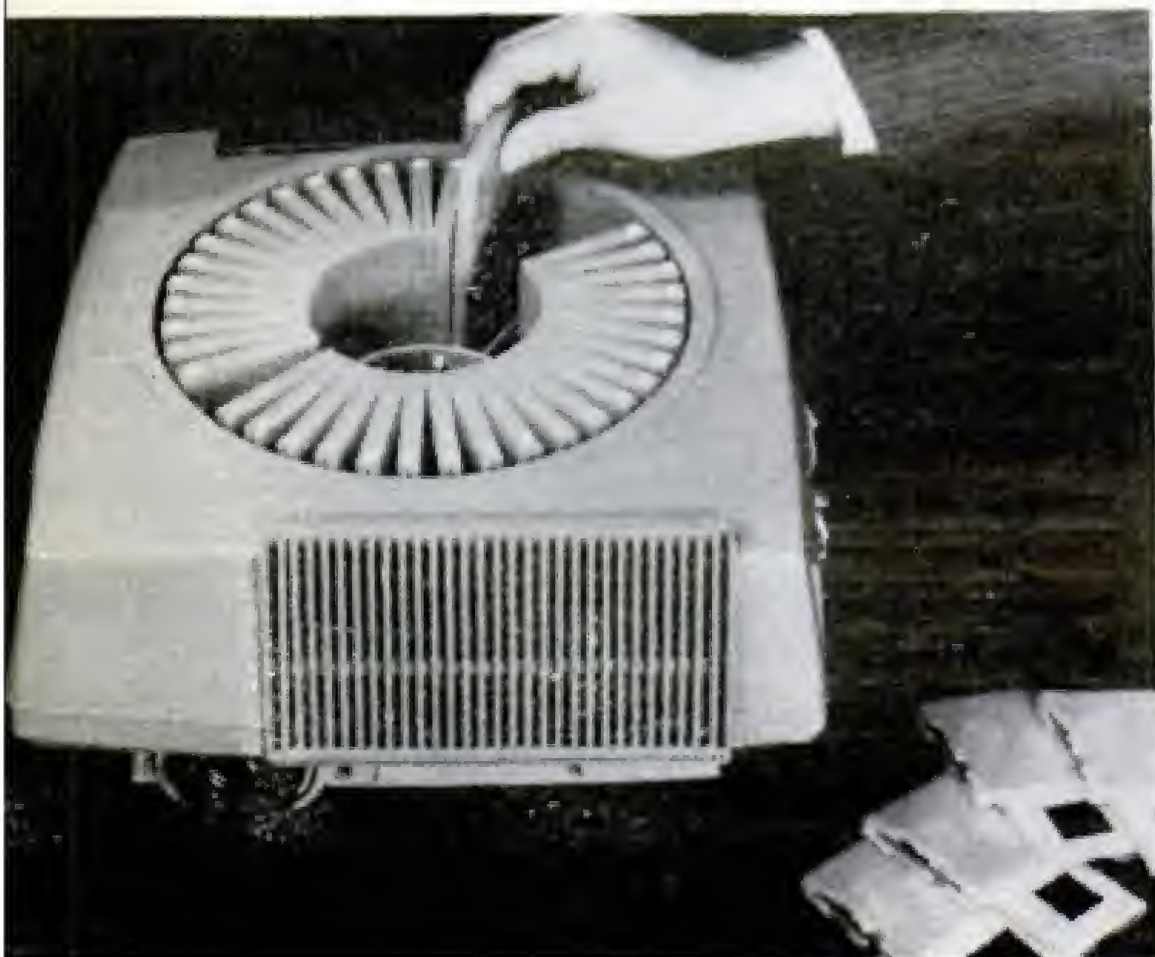


FIRST ELECTRONIC-FLASH POLAROID is this new Model 360 with a clever brightness control. The flash clips to the top of the camera and is interlocked with the focusing bar so its light intensity varies automatically with subject distance. As shown in the drawings, tiny louvers open wide on distant shots, then close as you focus on nearer objects to reduce the flash's brilliance. For recharging, the flash fits onto a small plug-in charger shown at upper right. For natural-light shots, there's also an electric-eye exposure control. A timer on the back (photo on facing page) tells you when film is developed so you don't have to bother counting. The camera takes color or black-and-white, sells for \$199.95.

ADDING SOUND TO SLIDES is easy with this accessory tape-recording unit designed to sit on top of Kodak Carousel projectors. Each slide fits



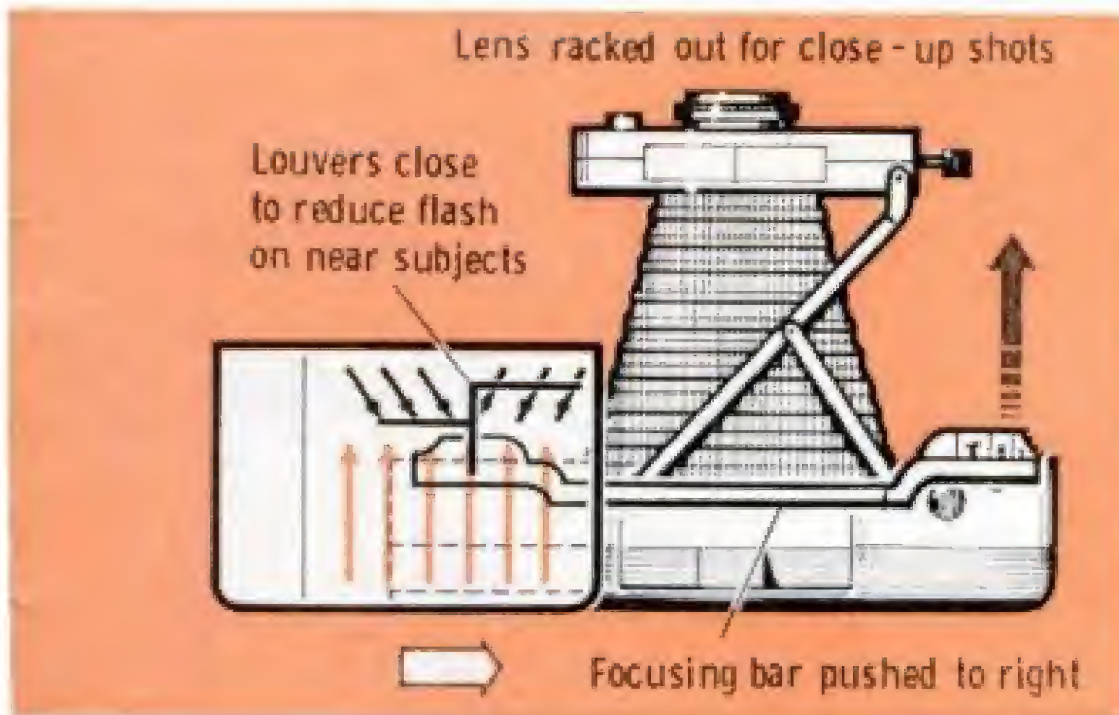
into a plastic holder that also contains a miniature tape cassette. The cassettes ride in the upper rotary tray, while the slides hang down into the conventional projector tray underneath. As each slide is projected, up to a minute of home-recorded commentary plays automatically. The new attachment, developed by The Kalart Co., Inc., Plainville, Conn., will sell for \$325.



PHOTOGRAPHY



IT TAKES ONLY 15 MINUTES to recharge nickel cadmium batteries used in Honeywell flashguns with the Rapid Charger below—an overnight job before. Battery clip (at right in upper photo) is removed from the gun and inserted in top of the charger (lower photo). With a spare clip, you can have unlimited flashes, using one as other is charging. Charger can be used with Honeywell Strobolar 700 and 770 guns and sells for \$39.95.



NEW CARTRIDGE-LOADING movie projectors from Kodak take the fuss out of threading and rewinding Super-8 film. You just drop in a cartridge and the film threads by itself onto the takeup reel, then rewinds automatically

back into the cartridge. Cartridges (left, below) come in 50 and 100-foot sizes. Two Instamatic projectors are the M105 at right for Super-8 film at \$139.50 and M109 at left for either Super-8 or regular 8 film at \$159.50.



ZOOM YOUR WAY TO BIGGER,

Handy variable-range zoom lenses, now available at moderate prices, can replace half a dozen separate lenses. Here's what they do and how to shop for one

By PHIL GERACI

Technical Art for PM by Fred Wolff

IT'S THE START of the big game and the players are lined up for the kickoff. You back off on your lens to get a full view of the field. As the ball sails through the air, you quickly switch to a medium-range focal length to pick up the receiver as he makes the catch.

Finally, you zoom in real close for a dramatic shot of the runner as he goes down under a mass of tacklers.

In the space of a few seconds, you've made three separate pictures, all at different focal lengths, all showing different types of action and all shot from the

SECRET OF A ZOOM lies in a set of movable lens elements that slide back and forth, as shown in this cutaway view. As these move backward, they increase the focal length, enlarging the image on the film to give you dramatic close-ups. Moving them forward decreases the focal length, making the image smaller but including more of the scene in your picture. At the same time, the "focus compensator" lens also moves back and forth slightly to keep the image sharp so you don't have to refocus. Drawing is patterned after Vivitar lens, typical of many high-quality, moderate-priced zooms now available

FRONT
ELEMENTS
ADJUST
FOCUS

ZOOM ELEMENTS
RIDE IN SPIRAL-
SLOTTED TUBE,
SLIDING BACK AND
FORTH AS TUBE
IS ROTATED

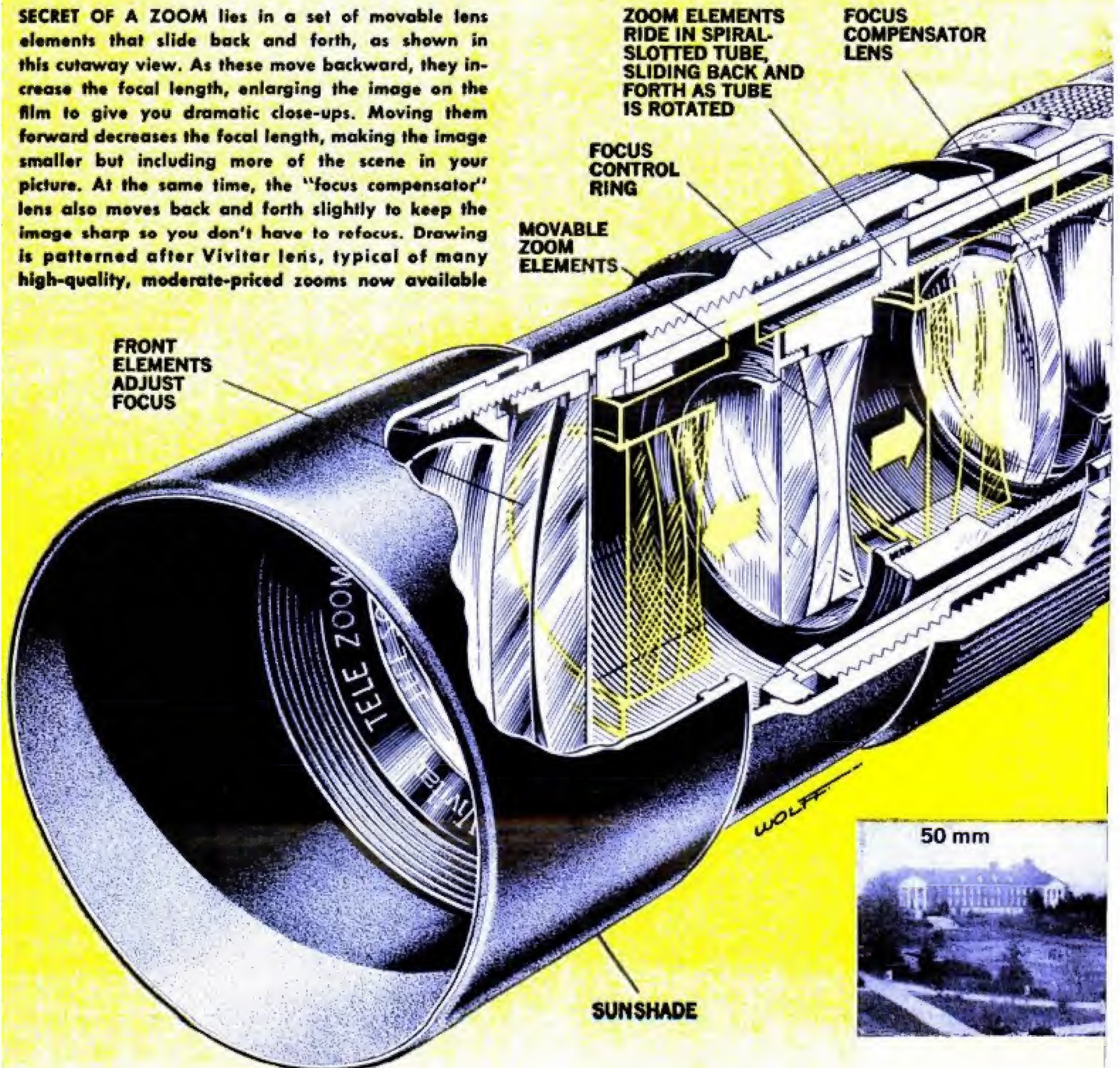
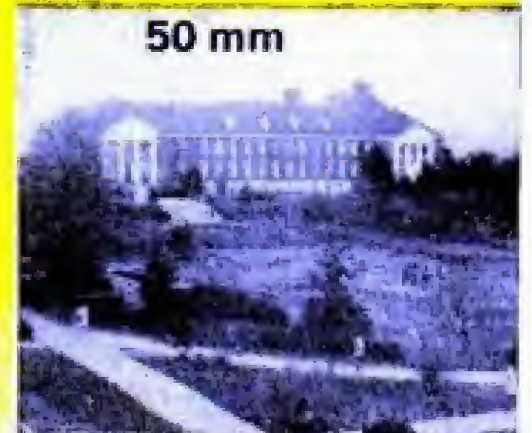
FOCUS
COMPENSATOR
LENS

FOCUS
CONTROL
RING

MOVABLE
ZOOM
ELEMENTS

SUNSHADE

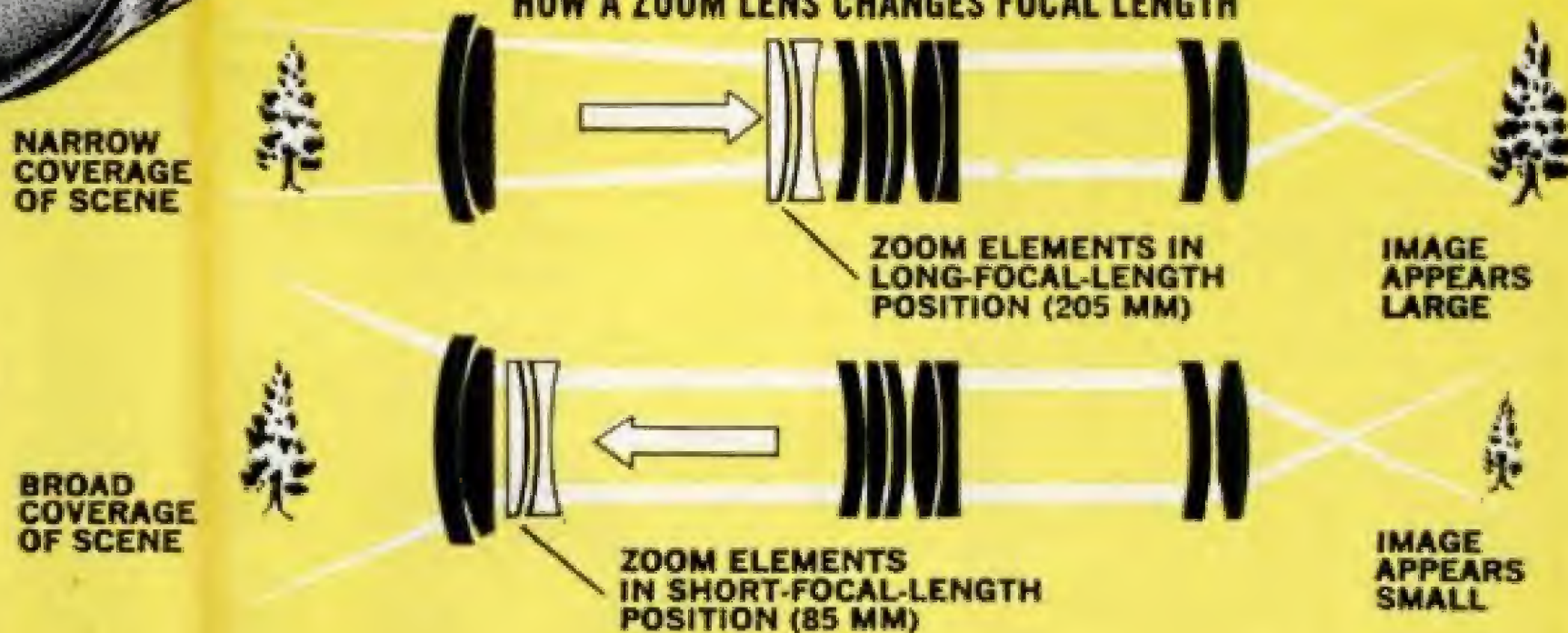
50 mm



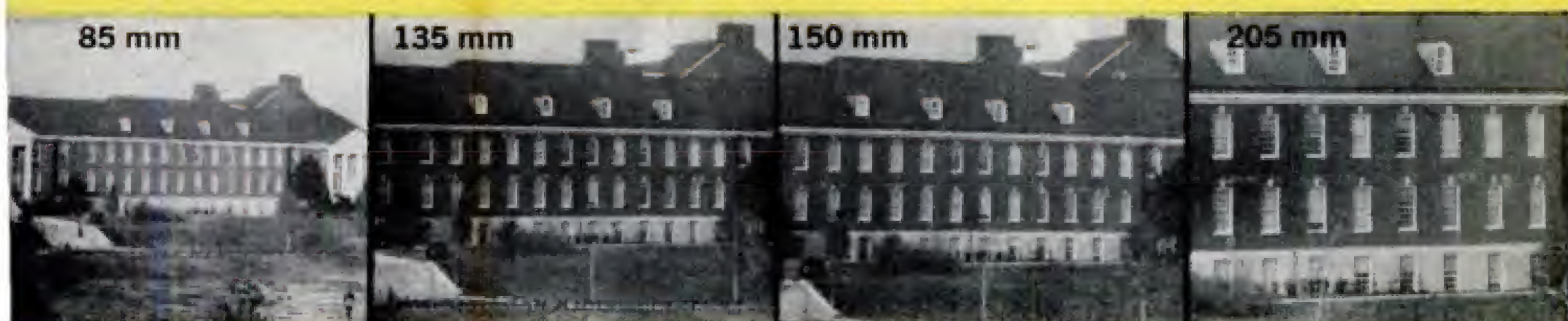
BETTER PICTURES



HOW A ZOOM LENS CHANGES FOCAL LENGTH



PROGRESSIVE PICTURES below show how a building looks at different focal lengths from the same distance. At far left is view seen with normal 50-mm lens. Image is magnified as you zoom from 85 to 205 mm





PISTOL-GRIP DESIGN helps balance lens's weight, is preferred by some zoom users. This 85 to 210-mm Sun has handy trigger-controlled shutter release, sells for \$149.95 from Spiratone in Flushing, N.Y.



TURNING A RING varies the focal length on most zoom lenses. This Vivitar, sold by Ponder & Best in Los Angeles, zooms from 85 to 205 mm. Price is about \$195 for automatic model, \$152 for manual

same spot in the stands. This is the kind of fun and excitement you can have with a zoom lens on a 35-mm single-lens reflex camera. You not only can switch rapidly from one focal length to another, but you don't have to worry about refocusing, either. Once you've focused on your subject, a zoom lens lets you vary the size of the image without affecting its sharpness.

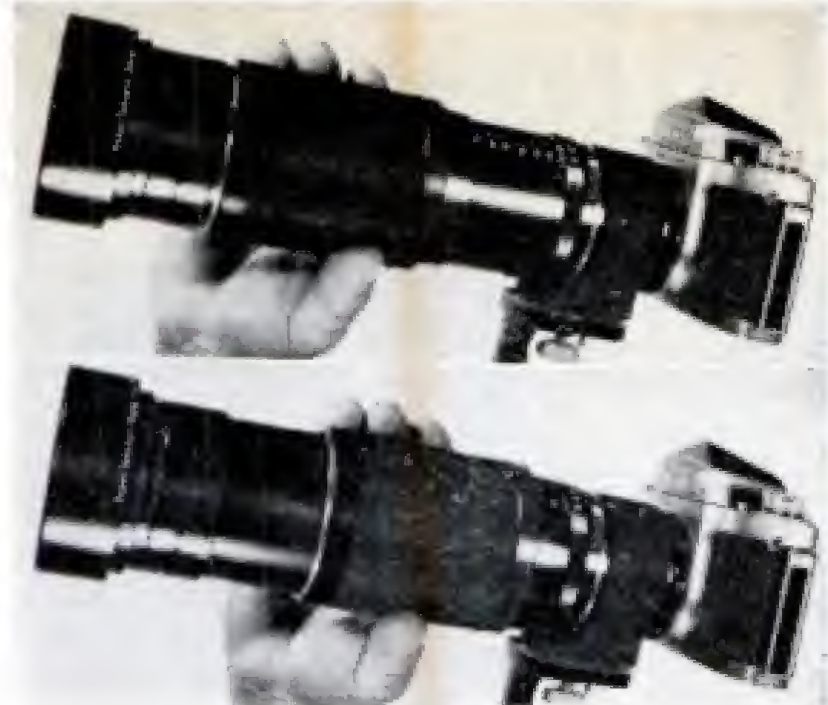
Until recently, zoom lenses were expensive toys for wealthy camera buffs.

Now this is no longer true. There are several selling for less than \$100 and dozens to choose from in the \$100 to \$200 range. In many cases, the price of a zoom is little more than that of a comparable telephoto lens of fixed focal length. With a single zoom, you can have the equivalent of half a dozen fixed lenses at a fraction of the cost.

Surprisingly, zoom lenses are not new in principle. "Variable telephoto" lenses,

FOOTBALL SEQUENCE at left below shows how zooming can help you shoot different types of action. Shot at top was made at 85 mm to get whole line of players at kickoff. Tighter middle view, at 135 mm, shows receiver starting runback. In bottom shot, camera zooms in close at 205 mm to catch runner as he's tackled. Row of zoom lenses shows typical range of sizes, from tiny 43 to 86-mm shorty at left to tall giant at right that goes all the way up to 600 mm





UNUSUAL TWO-IN-ONE CONTROL uses a single collar to adjust both focus and zoom range on this Super Takumar lens sold by Honeywell. Sliding collar back and forth varies focal length from 70 to 150 mm. At same time, you turn collar to focus. Price is \$395

as they used to be called, have been around since the early days of moviemaking. Though crude, they offered a simple substitute for the more cumbersome "dolly" technique where the entire camera must be moved to change image size. Spurred on by the need for variable TV-camera lenses, the zoom has now become a versatile aid for the still photographer as well, making a perfect companion for the single-lens reflex.

For SLR owners, zooms mean less weight in the gadget bag, and quicker camera operation. It's much faster to zoom than to change lenses. You can make your image fill the film frame from virtually any distance and thus reduce the amount of enlargement needed later, giving you greater sharpness and less grain. You can zero in on any portion of the scene you want, cropping out distracting details and composing your picture to good proportions right in the viewfinder.

A zoom lens works because it is able to change its focal length at will. Focal length is determined by the lens-to-film distance when the lens is focused at infinity. The longer the focal length, the larger the image on the film. In a conventional fixed-length telephoto, most of the lens elements are stationary, producing an image of fixed size on the film. The only elements that move are

(Please turn to page 210)

Medium-Range Zooms (70-250 mm)

Brand	Zoom Range (mm)	Speed	Cameras	Price
Super Takumar Zoom	70-150	f/4.5	Most SLRs	\$395.00
Accura Diamatic Zoom	70-230	f/4.5	Most SLRs	On request
Auto Tamron	70-220	f/4	Most SLRs	249.95
Proxitel Zoom	70-230	f/4.5	Most SLRs	On request
Auto Komura Zoom	75-150	f/4.5	Most SLRs	199.50
Auto Yashinon Zoom	75-230	f/4.5	Most SLRs	199.95
Yashinon-R	75-230	f/4.5	Most SLRs	179.95
Auto-Yashinon/DX Zoom	80-160	f/4	Most SLRs	229.95
Auto Zoom Rokkor	80-160	f/3.5	Minolta	329.50
Petri Zoom	80-200	f/4.5	Petri	298.50
Schneider Auto-Variogon	80-240	f/4	Most SLRs	551.00
Schneider Tele-Variogon	80-240	f/4	Most SLRs	400.00
Auto Rokunar Zoom	80-250	f/3.8	Most SLRs	269.50
Bushnell	80-250	f/3.8	Most SLRs	285.00
Auto Tamron	80-250	f/3.8	Most SLRs	299.95
Vivitar Zoom	85-205	f/3.8	Most SLRs	194.95
Caspeco	85-210	f/4.8	Most SLRs	80.00
Sun Auto Zoom	85-210	f/4.8	Most SLRs	149.95
Alpa Enna Zoom	85-250		Alpa	299.00
Auto-Nikkor Zoom	85-250	f/4	Nikon	515.00
			Nikkormat	
			Nikkorex	
Enna Telezoom	85-250	f/4	Most SLRs	249.50
Topcor Auto Zoom	87-205	f/4.7	Topcon	334.00
Super Yashinon R Zoom	90-190	f/5.8	Most SLRs	129.95
Rikenon	90-190	f/5.3	Most SLRs	155.95
Auto Soligor	90-230	f/4.5	Most SLRs	269.50
Soligor	90-230	f/4.5	Most SLRs	169.50
Rokunar	95-205	f/5.6	Most SLRs	179.50
Bushnell	95-250	f/5.6	Most SLRs	159.50
Canon FL Zoom	100-200	f/5.6	Canon	199.95
Caspeco	100-200	f/5.6	Most SLRs	100.00
Kaligar	100-200	f/5.6	Most SLRs	99.50
Zoom Rokkor	100-200	f/5.6	Minolta	184.50
Soligor Zoom	100-200	f/5.6	Most SLRs	139.95
Telesar	100-200	f/5.6	Most SLRs	109.50
Zuiko	100-200	f/5	Olympus Pen	199.95

Short Zooms (36-135 mm)

Brand	Zoom Range (mm)	Speed	Cameras	Price
Voigtlander Zoomar	36-82	f/2.8	Most SLRs	\$300.00
Vario-Sonnar	40-120	f/2.8	Contarex	648.00
Auto-Nikkor Zoom	43-86	f/3.5	Nikon	179.50
			Nikkormat	
			Nikkorex	
Schneider Auto-Variogon	45-100	f/2.8	Most SLRs	436.00
V-Hexanon	47-100	f/3.5	Konica	199.95
Zuiko Auto Zoom	50-90	f/3.5	Olympus Pen	159.95
Auto-Zoom Rokkor	50-100	f/3.5	Minolta	249.95
Rokunar	55-90	f/4	Most SLRs	150.00
Canon FL Zoom	55-135	f/3.5	Canon	278.50

Long Zooms (160-600 mm)

Brand	Zoom Range (mm)	Speed	Cameras	Price
Auto-Zoom Rokkor	160-500	f/8	Minolta	\$749.50
Rokunar	200-400	f/6.3	Most SLRs	199.50
Auto-Nikkor Zoom	200-600	f/9.5	Nikon	515.00
			Nikkormat	
			Nikkorex	

Specialty Zooms (extreme ranges)

Brand	Zoom Range (mm)	Speed	Cameras	Price
Auto-Nikkor Zoom	50-300	f/4.5	Nikon	\$720.00
			Nikkormat	
			Nikkorex	
V-Hexanon	58-400	f/4	Konica	On request
Canon FL Zoom	85-300	f/5	Canon	548.50

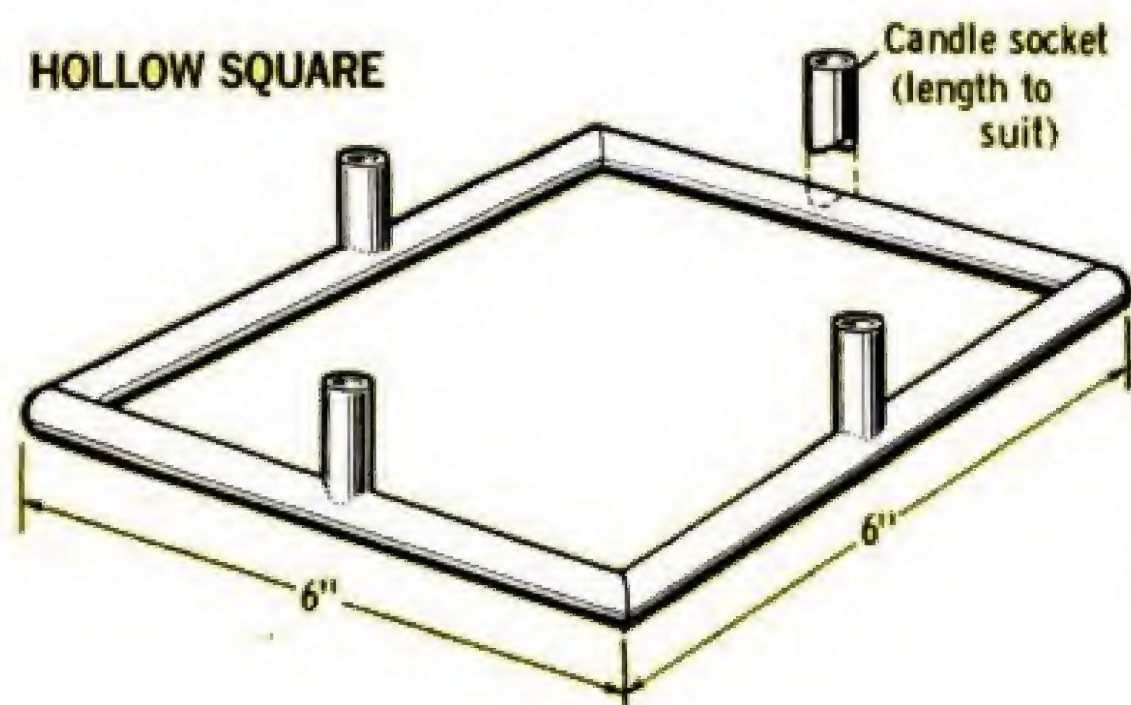
Weekend 'Thinwall'



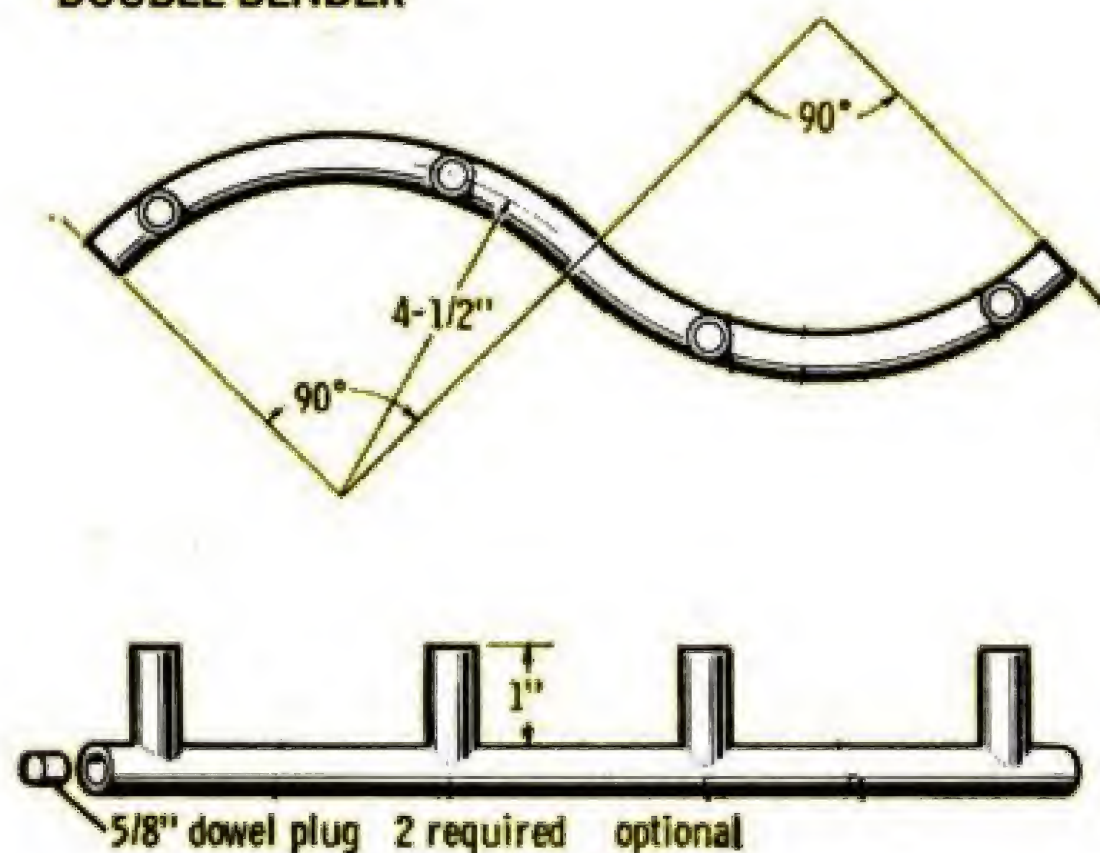
TWO CANDLEHOLDERS



HOLLOW SQUARE



DOUBLE-BENDER



By R. S. HEDIN

IT'S NOT ALWAYS necessary to spend a lot of money and time to turn out good-looking, functional projects in your shop. Using thinwall steel conduit (the type that is used in electrical work), any of these projects can be built and finished in a single weekend.

Sold in 10-ft. lengths, thinwall conduit is zinc-plated steel tubing with an inside diameter of $\frac{5}{8}$ in. and a wall thickness of about .040 in. (hence the label, thin-wall). Low in cost, about 10 cents per foot, it is extremely ductile and can be bent easily without crimping.

Except for the hickey (conduit bender), you probably already have the tools you need for working with thinwall. Lacking a hickey, you can rent one for a day and knock out all your bending work in one session. But, if you want to add one to your toolbox, Sears offers one for about \$8. You supply a length of pipe for the handle.

Though no special skills are

POPULAR MECHANICS

Projects

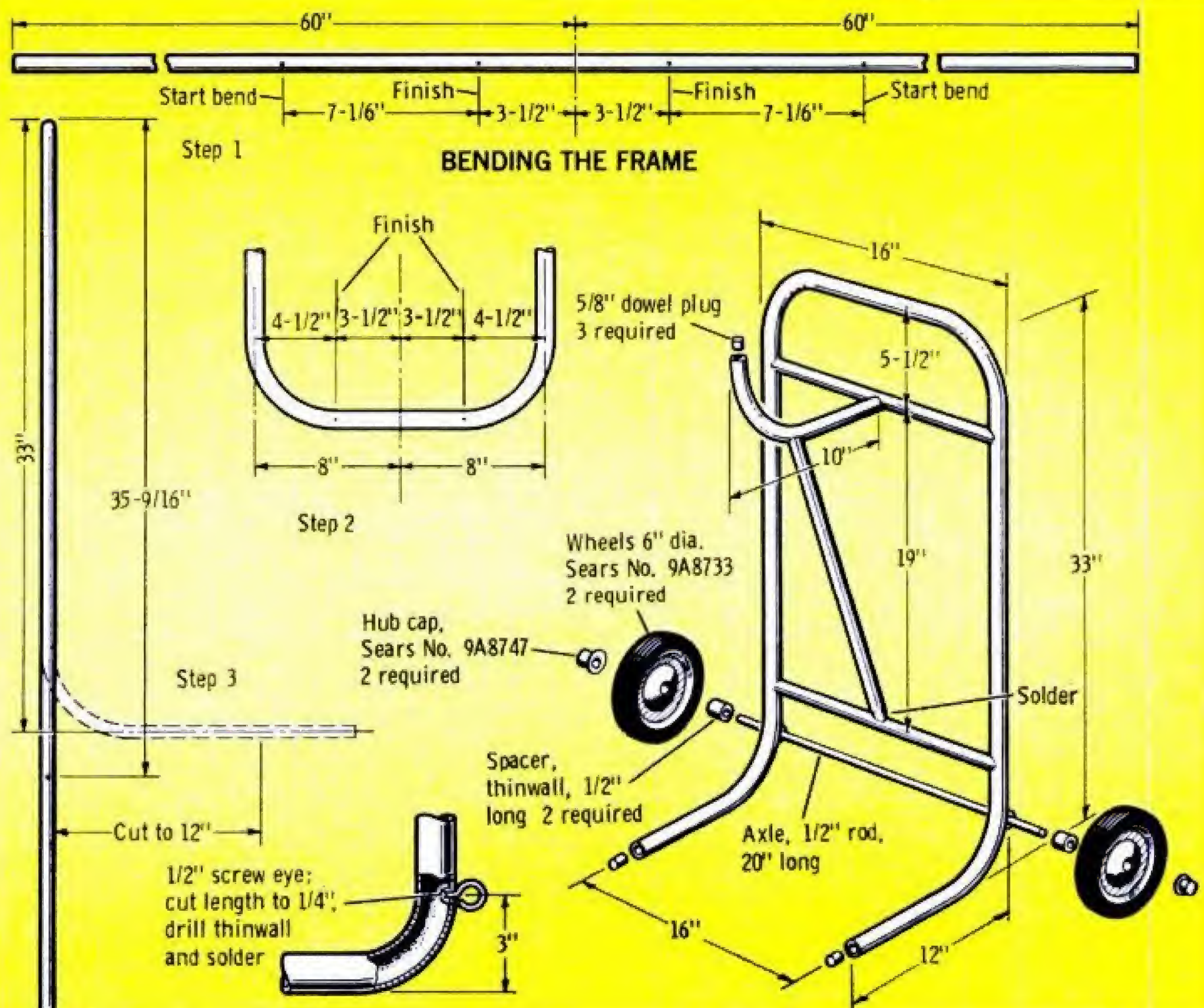
needed, these four projects do require some knowledge of the basic techniques for working with thinwall. Here's a quick rundown on what you should know about handling thinwall conduit.

● **Cutting.** Use a fine-toothed hacksaw to cut parts and rough out joints. For square cuts, a tubing cutter gives an almost perfect cut. Cutting goes best (when using a hacksaw) if the work is clamped in a miterbox as shown on page 167. To insure tight joints, dress all cuts with a smooth file.

● **Bending.** Since the bend radius is $4\frac{1}{2}$ in. at the center of the tubing, you need approximately $7\frac{1}{16}$ in. around the bend to make a bend of 90° . Using this information, bends can be made with



HOSE CART





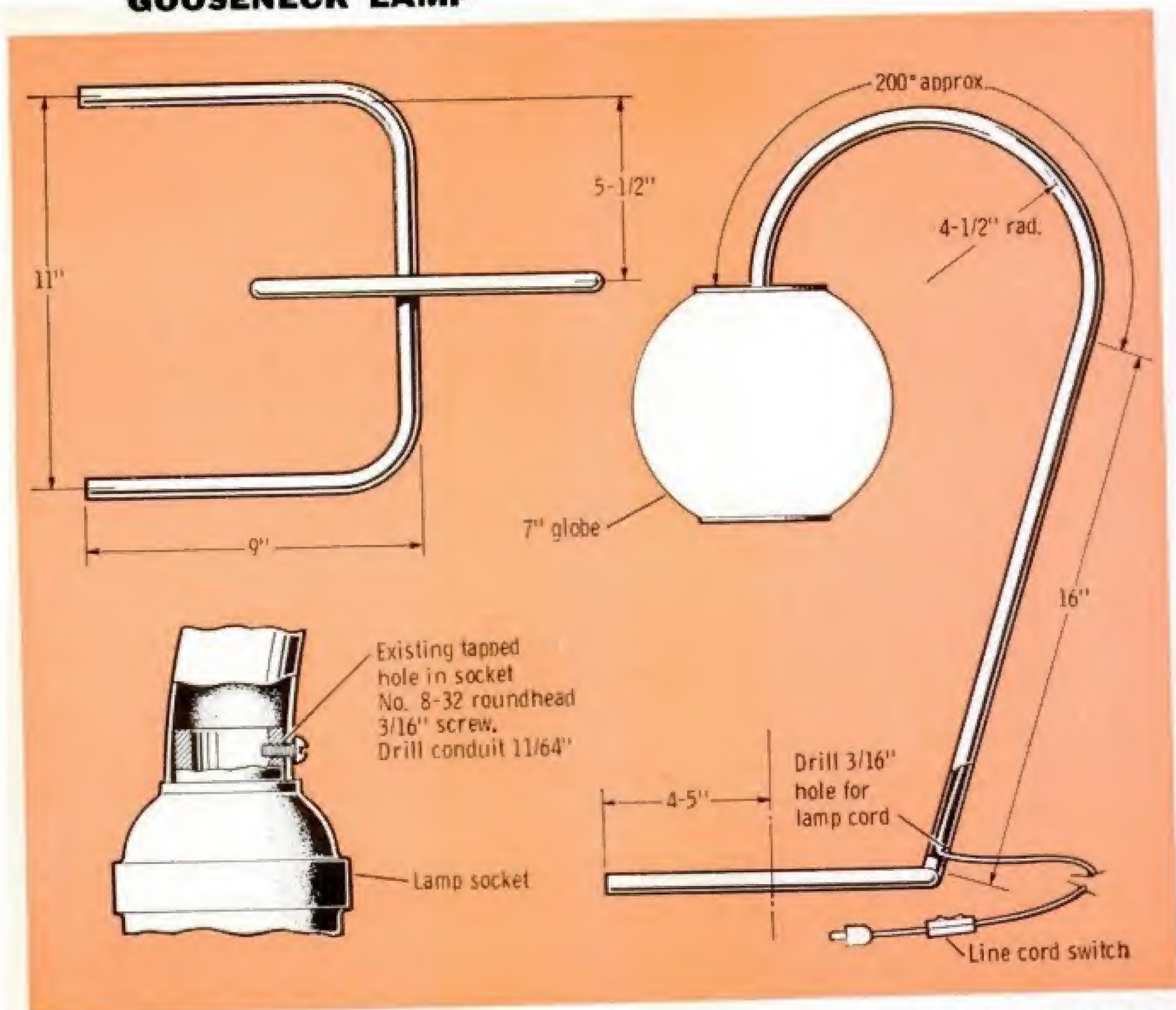
GOOSENECK LAMP

some degree of accuracy. Bends of up to 180° (or more) can be made by slipping the hickey along the curve, but this takes a little practice. Don't be discouraged if the first attempt is somewhat less than perfect. When making a 90° bend, always check the finished work with a square.

● **Soldering.** All soldering is done with silver solder. Sold locally, this is a silver alloy—about 45 percent silver—with a melting point of about 1125° F. It flows freely at 1145° F. A special flux is used in silver soldering; it comes in wet paste form and sells for about 75 cents per half-pound. It is thinned with water and applied with a brush.

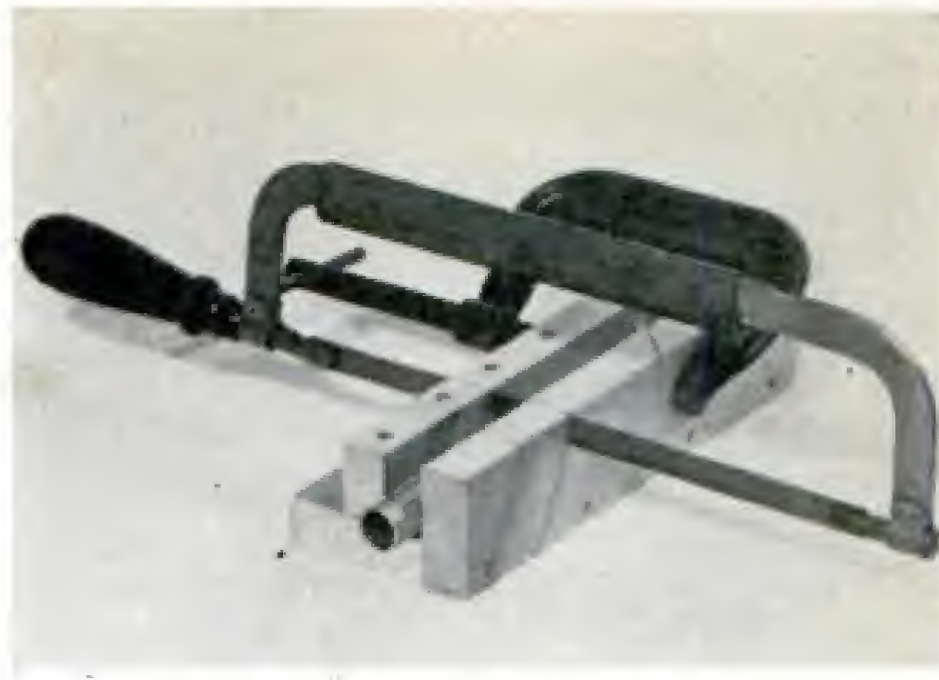
Before soldering, file off the zinc coating on the joint surface. Next, put a light coating of flux on both surfaces and position the pieces. (Note: Flux must be between the mating surfaces).

With the torch turned full-on, heat the joint all around until the water in the flux evaporates and the flux turns





SIMPLE WOOD JIG holds the work securely, is built with space between the blocks to prevent scorching



DO ALL CUTTING with a 32-tooth hacksaw. Miterbox will assure craftsmanlike square and miter cuts



TO MAKE BUTT JOINT, the tubing is rough-sawn to shape, filed to fit conduit and then silver-soldered

white. After that, concentrate the heat equally on both parts, keeping the flame pointed at one spot until the flux melts. At this point the tubing will be near a dull red color. Apply the solder wire to the joint, letting the work—not the torch—melt the solder.

After melting a small amount of solder, work the torch around the joint and the solder will follow. When the solder stops flowing, apply more solder and continue on around. If you start at the top of the joint, gravity will work for you in pulling the solder around. However, in a good close-fitting joint, solder will actually run uphill.

Next, let the joint cool and remove the flux with a wire brush or water. When finished, a good joint will have a fillet of solder at the junction of the surfaces.

Tips: If this is your first crack at soldering, make a couple of test joints to get the feel of it. Do your soldering in a well ventilated area and avoid breathing the flux fumes.

All of the projects shown were prepared for painting by wirebrushing and sanding to remove loose plating and flux. To finish, I chose spray-can paint for a professional-looking job that requires a minimum of effort. ★★★

OCTOBER 1969



HICKEY IS PLACED on bend-start mark (top), and pressure applied. At finish mark bend is 90°. To bend 180°, pipe passes handle, must be straightened

Instant Cement Fills Cracks For Good



BOLT EMBEDDED in slab with Quik-Rok is permanently held. As it sets, cement expands, develops strength



AS IT BEGINS TO SET, 15 minutes after mixing, the cement can be smoothed with a trowel or knife



TO FILL CRACKS in concrete slab, wet the crack and dribble in cement, smooth off excess as it sets

AS IT COMES from the package, Preco Chemical Corp.'s new patching cement, Quik-Rok, looks much the same as portland cement. When it is mixed as recommended with water, it looks like gray plaster of paris. But it is neither.

It's an expanding, nonportland hydraulic cement, one of the latest developments in cement technology. The difference is that ordinary portland cement shrinks slightly as it sets. An expanding cement expands slightly and hardens without shrinking. When it is poured into a recess that restricts its expansion—a hole, for example—it prestresses itself as it hydrates (combines with the water) and develops a very high compressive strength. A 1/2-in.-dia. bolt embedded in a hole in concrete with expanding cement, for example will snap before it pulls out.

Quik-Rok hydrates rapidly, setting firm in 15 minutes, hardening in an hour and curing to full strength in 5 days (compared to 28 days curing time for portland cement). This rapid chemical reaction

generates considerable exothermic heat. Immediately after its initial set, a large pour heats enough to give off a slight amount of steam.

Mixing proportions aren't critical. While the ideal consistency is about that of pancake batter; the recommended mix for the average job is 2½ parts cement to 1 part water. But a thicker, puttylike mix also cures satisfactorily, and for many repairs the thicker mix is easier to apply and finish. Mixed either way, the working life of the mix is about the same—very short. Don't mix more cement than you can use in 10 minutes.

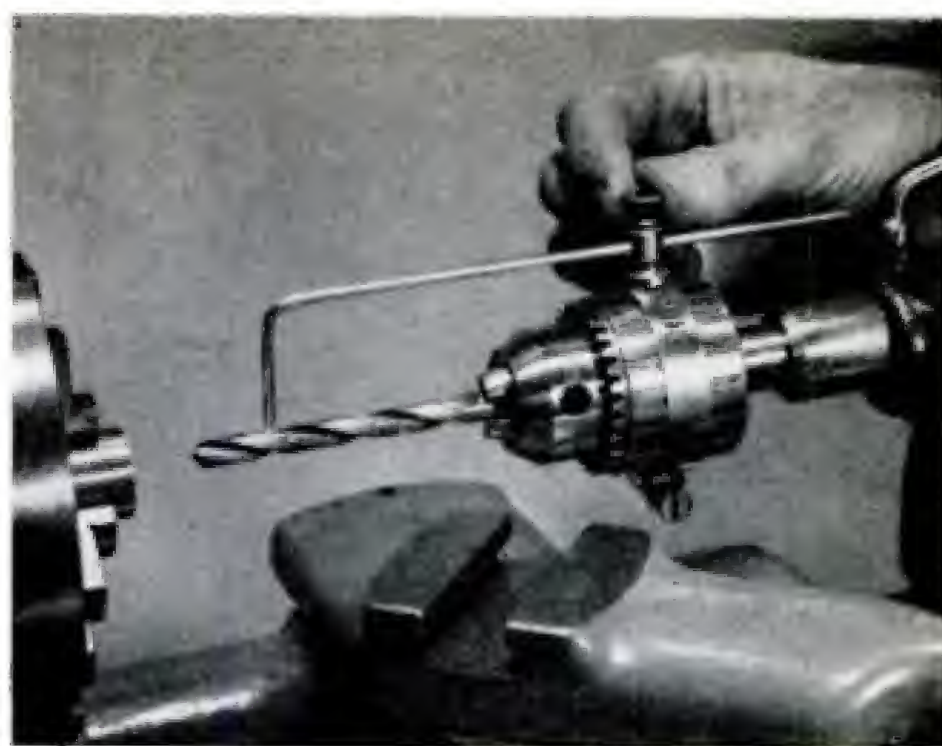
For maximum strength, apply Quik-Rok at least 1/2-in. thick. However, it can be used to fill hairline cracks provided they are first well-wetted. Having a high degree of weather and heat resistance, it is virtually an all-purpose cement.

Packaged in 1, 5, 25 and 50-lb. containers, Quik-Rok is sold through builders' supply firms and hardware stores. A one-lb. box costs 89 cents. ★★★

HINTS FROM READERS

Lathe drill gauge

Here's a simple depth gauge that serves as a great aid when drilling in the lathe. To make it, you need a hose clamp, binding post and length of rod. Mount post atop the clamp with a flathead screw and bend the rod at right angles to reach the drill's chuck jaws when in the post. With large drills, turn the rod so it rests in the drill's flute.—*Peter Legon*



Battery cable-clamp puller

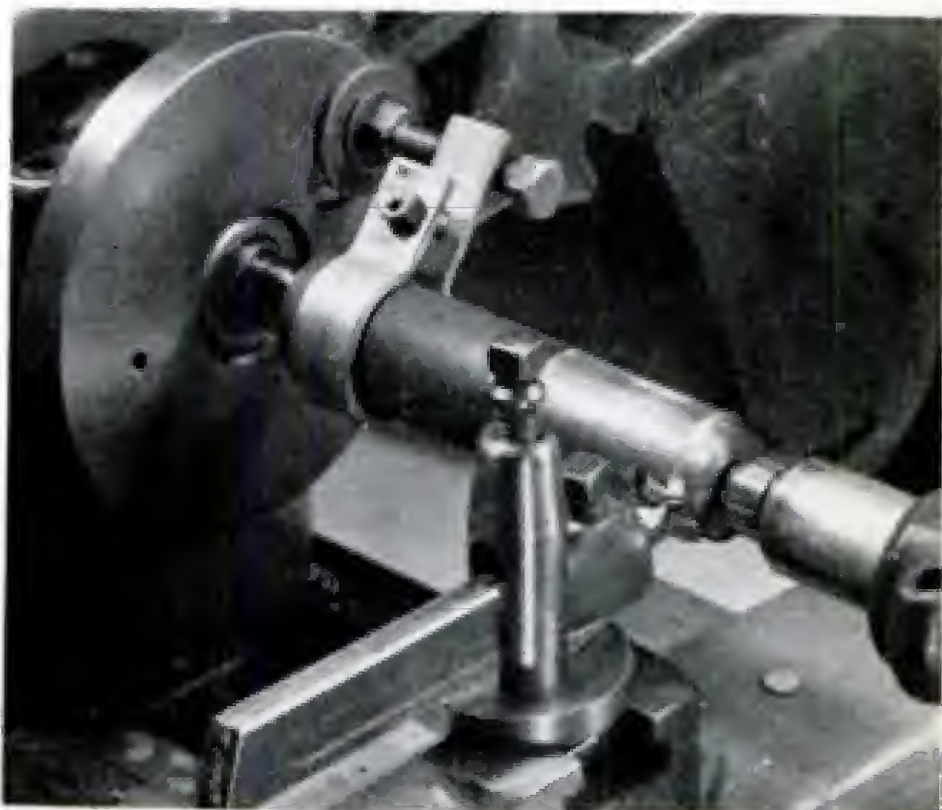
A corroded battery cable-clamp can be easily removed from the terminal with this puller. Drill and tap a short length of $\frac{1}{4}$ x 1-in. flat steel to receive two carriage bolts spaced to fit the clamp, plus a centered capscrew. Allow the boltheads to grip the clamp's lower face and tighten the capscrew to lift off the clamp.

—*C. W. Woodson*



Saving late tomatoes

If your plants are heavy with green tomatoes when the first frost threatens, you can still bring them to delicious ripeness and color. To do it, simply pull the plants up by the roots and suspend them upside down from a line stretched in your basement. In a few weeks the green tomatoes will turn red and boast vine-fresh sweetness.—*G.E. Hendrickson*



Lathe dog for large work

Large-diameter work can be turned between centers using a homemade lathe dog. First, bend a thin steel bar around the work to make a snug fit, then give the ends a sharp, straight-up bend to act as driving tail. Drill the ends for a clamp screw to hold dog securely, fasten a bolt with two nuts through the faceplate slot for driving dog and work.—*C.W. Woodson*



Lagscrew vise helper

To keep pipe from turning in a smooth-jawed vise when threading or cutting, you can use four lagscrews as shown at right. As you tighten the vise, the sharp screw threads bite into the pipe and hold it fast while you cut. One word of caution though: If using soft pipe, go easy on the muscle.—*Victor H. Lamoy*

Which Insulation



AVAILABLE IN GREAT VARIETY, insulations most often used are shown above: A, blanket; B, batt; C, sill sealer; D, roll; E, blown-in; F, pouring, and G, rigid. Text and art tell how and where to use them

There's a type for every job and, once installed, insulation pays for itself by cutting both heating and cooling costs

IF YOUR HOME is hot in the summer and chilly in the winter, it's a pretty safe bet that the house is underinsulated and you're throwing money away. Happily, you can still do something about it. And, if you are planning an attic renovation or addition, you can avoid the same problems in those areas.

All materials used in home construction offer some resistance to heat transfer from the warm side to the cold side. But, if you add a material with a high degree of resistance to heat transfer, comfort will be greatly increased—while fuel and air-conditioning bills go down. That's what insulation is all about.

Of four basic types—blanket, batt, loose and rigid—insulation is inexpensive and easy to install. In most cases you can handle the job yourself.

Blankets and batts are probably most commonly used and can be either mineral wool or fiberglass. The minimum recommended thicknesses are 4 and 2-in. for ceilings and walls respectively. Available with and without vapor barrier facings (which will be discussed later in this

article), it's safe to say that the thicker the material, the more efficient the job.

The job at hand usually dictates which type is best suited. Where wall insulation is wanted in an existing house for example, the smartest move is to call in a pro (and his equipment) for a "blown-in" installation. Blankets or batts would require the tearing down and rebuilding



STAPLING FLANGES are lapped over studs, provide vapor barrier. Notice loose insulation around jamb

Should You Use?

By BURT MURPHY



of entire walls to get the stuff in place.

Insulating between joists in a crawlspace or attic is a homeowner's task. Blankets or batts can be used in both areas or loose fill simply can be poured between joists in the attic.

On any new work such as an attic renovation or addition, where the framing members are fully exposed, consult the chart on the following page for the best choice of insulating material.

Unlike the insulating materials mentioned above, the rigid fiberboard type is installed over, not between, studs. Manufactured in standardized building sheet sizes, it comes smooth one side for finish painting.



UNSUPPORTED AREAS, such as a crawlspace, are insulated with batts held by galvanized screen wire

The most often used perimeter insulation is Styrofoam. Of varying thickness, it is installed around the perimeter (forms) as shown on page 174 before the slab is poured. It should also be used in heated crawlspaces that serve as return plenums.

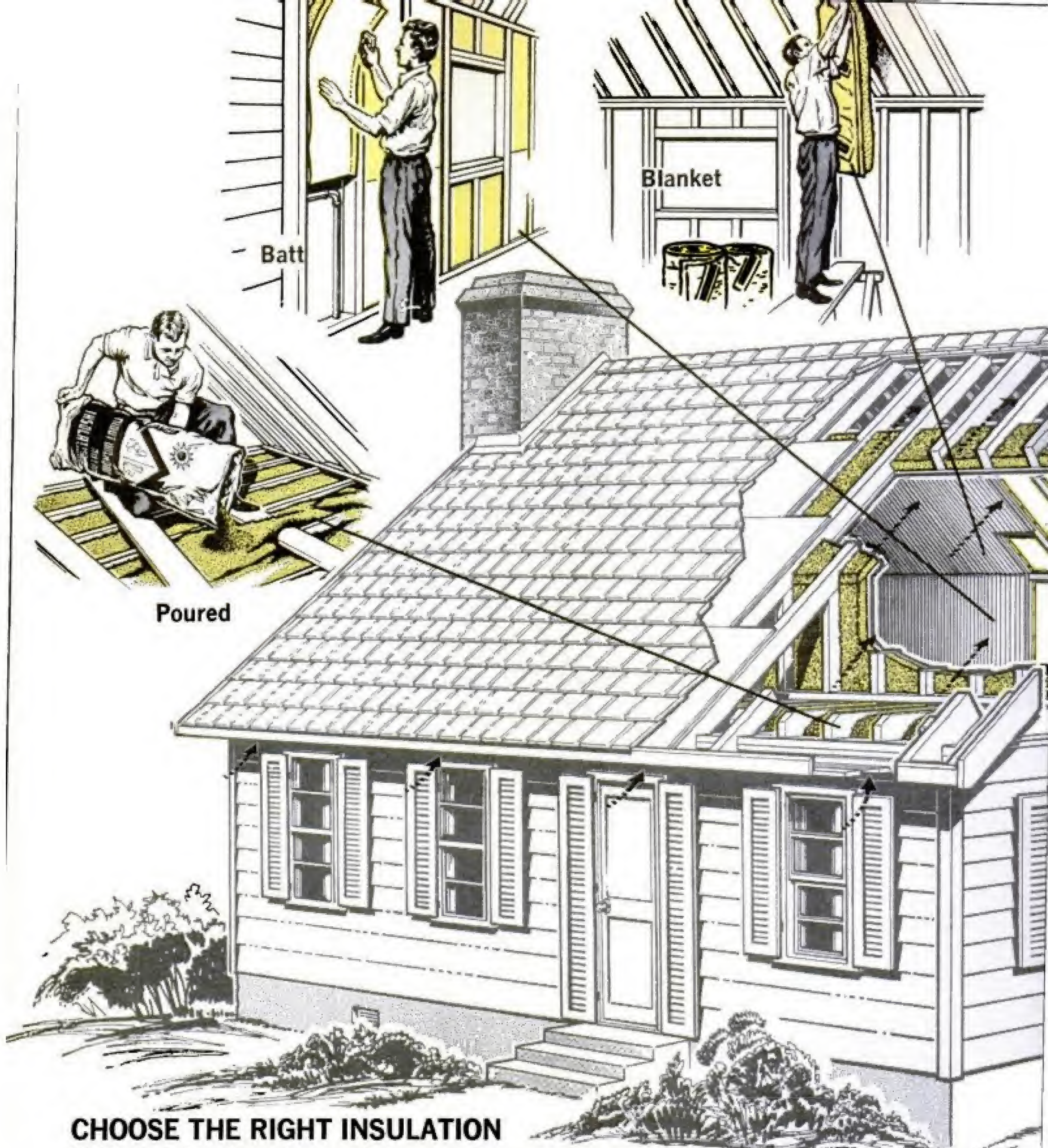
About vapor barriers

Most materials used in house construction are permeable to water vapor. Thus, water vapor generated in the air by dishwashers, showers, baths and the like, can travel through the walls and condense in the attic, eaves or crawlspace. This causes damage to exterior and interior finishes (blistering paint) and, sometimes, decay.

To prevent this, the house should be skinned with a water-resistant material (vapor-barrier) on the *warm* side of all exterior walls and between attic floor insulation and heated rooms below.

Most commercially available insulations now come with a vapor barrier on one or both sides. With these (excepting foil-faced types), the insulation is installed with the stapling flange on the face of studs. Blankets or batts lacking a vapor barrier are installed between studs and then covered with a vapor barrier such as 6-mil polyethylene or asphalt-saturated paper.

When insulation is blown-in in an existing home, paint coatings cannot be considered as a substitute for membrane



CHOOSE THE RIGHT INSULATION

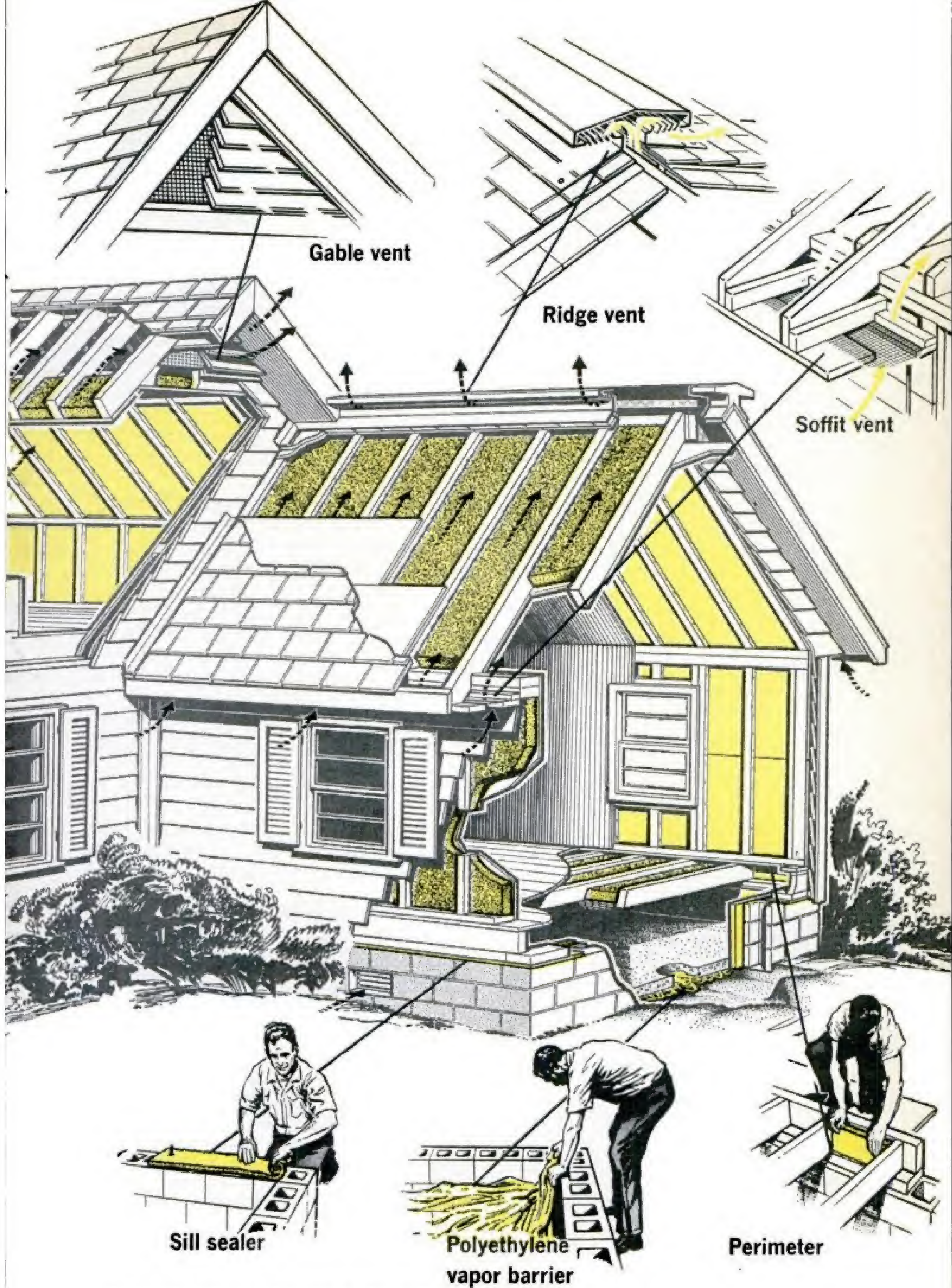
Fully insulated and vented, house gives greater comfort, costs less to heat and cool. Note that wherever used, insulation (shown in yellow) is placed between heated and unheated areas. Vent in crawl space is installed when that area is unheated. If heated, perimeter of foundation wall is insulated as shown.

TYPE OF INSULATION	WALLS	CEILING	FLOOR	FOUNDATION	ATTIC	SLAB	BASEMENT WALLS
Blankets, batts	✓	✓	✓		✓		✓
Poured					✓**		
Blown-in*	✓	✓**					
Sill sealer				✓			
Rigid (Fiberboard)	✓	✓	✓		✓		✓
Rigid (Perimeter)				✓***		✓	

*Existing house

**Floor of unheated attic

***Heated crawl space





VERMICULITE ATTIC INSULATION used to beef up inadequate insulation is poured between joists

types of vapor barriers. But one coat of aluminum primer followed by two decorator coats is quite effective. In drywall construction, paint coats can be applied to the back surface before installation.

Adequate ventilation is equally important. Until recently it was thought that venting a house caused wasted heat. But, with today's improved insulations, year-round fixed venting gives definite advantages. Used in the attic, it removes extreme heat in the summer and excess moisture from below in the winter.

How to insulate

No special tools are needed to install insulation. A stapler loaded with 5/16-in. staples, a large shears or utility knife and a ruler complete the toolkit. When insulating between ceiling joists, start at the outside-wall top plate and work across the room. Be sure the insulation doesn't block ventilation at the plate.



BLOWN-IN installation requires special knowledge and equipment, is a chore best left to the pros

In an attic where a finished ceiling is in place, batts or blankets may be laid in from above. Keep the vapor barrier face down and tightly butt the batts, or blankets, where they meet.

Joists over a crawlspace are insulated with the vapor-barrier side face up. If a vapor-barrier paper is used instead of 15-lb. felt over the subfloor, you can save dollars and use insulation without a vapor-barrier facing. To support the blankets, use well-nailed chicken wire as shown in the photo or, rustproof wire laced in boot fashion around roofing nails set at intervals in the joists.

Basement walls can be insulated by fastening 2x2-in. furring strips to the wall to simulate framing and blankets installed between, or the strips can be faced with insulation board.

Whether installing insulation on walls or ceiling, leave space for ventilation between sheathing and insulation. ★★★



FOIL-FACED insulations are stapled to stud sides to provide air space between foil and back of wall



SLAB HOUSE construction calls for rigid insulation placed around perimeter. Notice vapor barrier

POPULAR MECHANICS

HINTS FROM READERS

Basket prevents fan accidents

A plastic clothes basket, placed over an electric fan, will keep youngsters (and pets) from reaching the whirring blades. For extra safety, mount the setup on a piece of plywood and secure the basket with screws and pipe-strap hold-downs. Then the youngsters will not be able to move or tip the basket.—*Ken Patterson*

Easier-to-use mason line

Tired of untying and tying knots every time I had to move my mason's string when laying out my patio, I hit on this idea. By fitting the end of the line with a wire terminal, I can simply slip it on or off nails tacked in the stakes. I found the best terminals for this application were those that grip small, insulated wires firmly.—*Daniel Bousha*

Clenched fist saves a dime

I am farsighted and don't always have my eyeglasses handy. Thus, if I have to look up a number at a telephone pay station, I'm hurting. To make the numbers stand out clearly, an optometrist told me to clench a fist and peep through the hole between thumb and index finger. Make the hole small as possible, and hold your fist close to the eye.—*Stephen Stresnic*

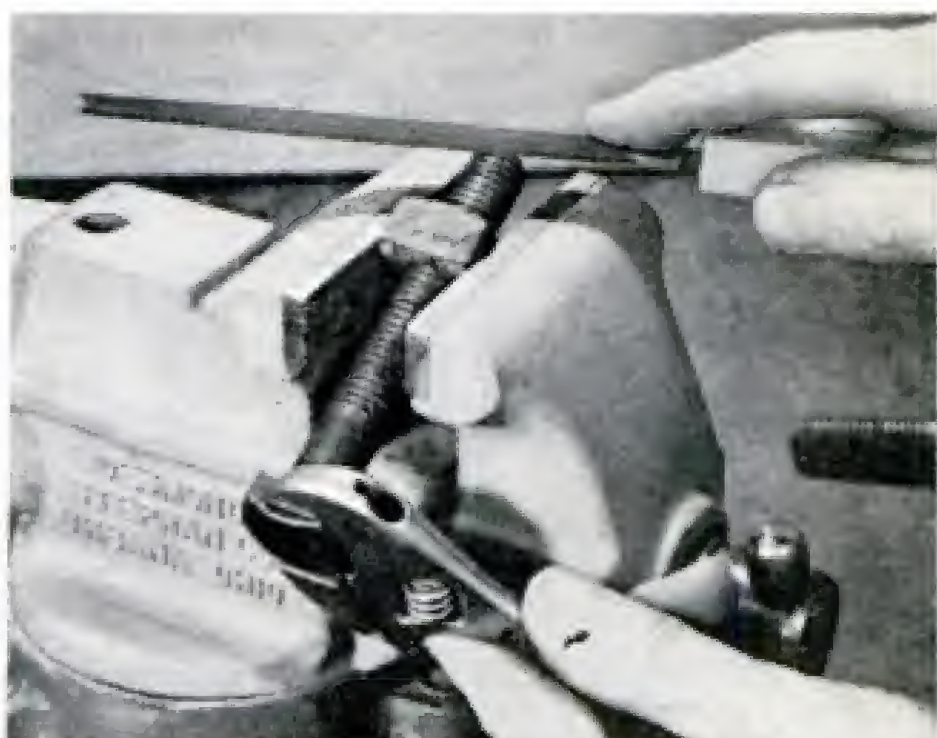
Easy way to chamfer a cut bolt

If you've ever cut a bolt you know that gripping the bolt in one hand, while you file burrs on the cut with the other, is not a pleasant chore. Next time try this: Run a nut on the bolt, then clamp the nut in your vise. Using a wrench, rotate the bolt slowly as you file. With a little practice, you'll have a uniform conical chamfer every time.—*Robert Beck*

Heat sink aids grinding

A heat sink is the answer when shaping hardened tool steel. I found that out when shaping special cutters for my table saw molding cutterhead. A $\frac{1}{4}$ or $\frac{1}{2}$ -in. piece of aluminum scrap is so efficient that even a high-speed grinder will not overheat the cutting edge. If you use a small bench grinder, secure tool to the aluminum block with a small C-clamp.

—*Frank Greenwald*





All-Season 'Ski Lodges'

Tucked away in wooded back country or along water frontage these four vacation dream homes let you live the good life

WHETHER IT SERVES as a hide-away for a weekend of skiing or as a year-round haven where you can enjoy boating and fishing too, nothing promises to pay you such big dividends in pure pleasure as a second home.

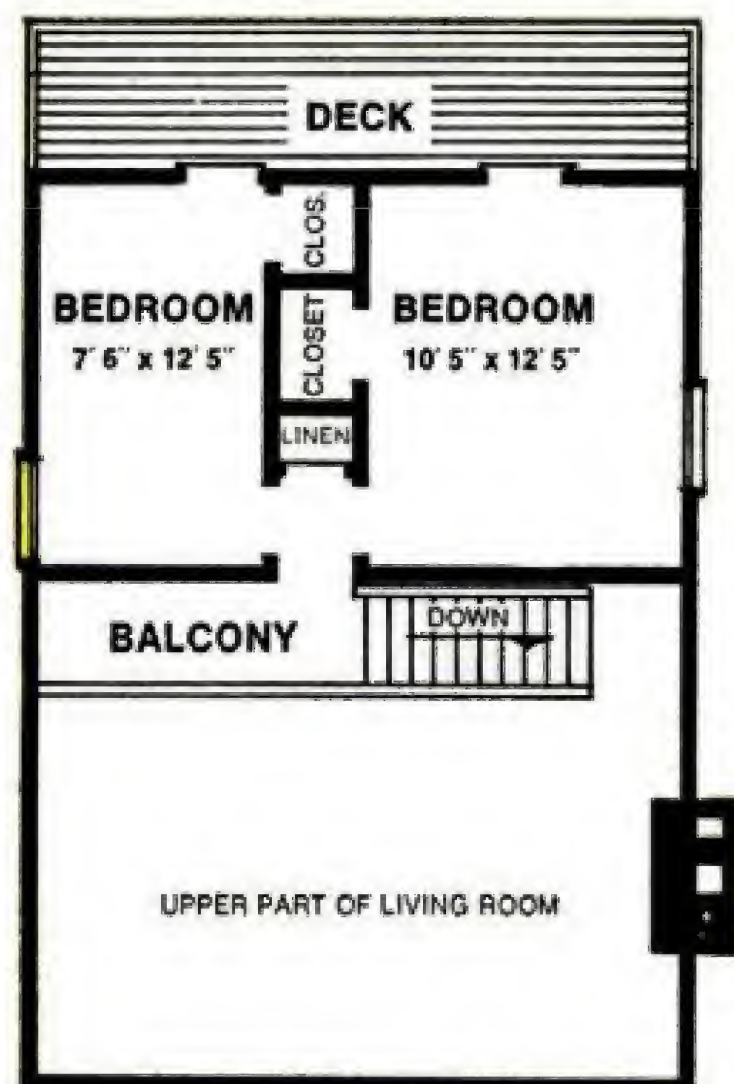
You'll find a home away from home is really a risk-free investment in the good life. It means periodic relief from tensions and frustrations of the work week. It adds new dimensions to vacation living for the whole family. And it may be the perfect answer to the housing needs of your retirement years.

Be it a rugged ski lodge or a sophisticated beach house you're dreaming of, each of the four vacation homes pictured here lets you save money several ways. First you may have a contractor erect the structural shell and then finish off the rest at your leisure. Or you can build all or most of the house yourself.

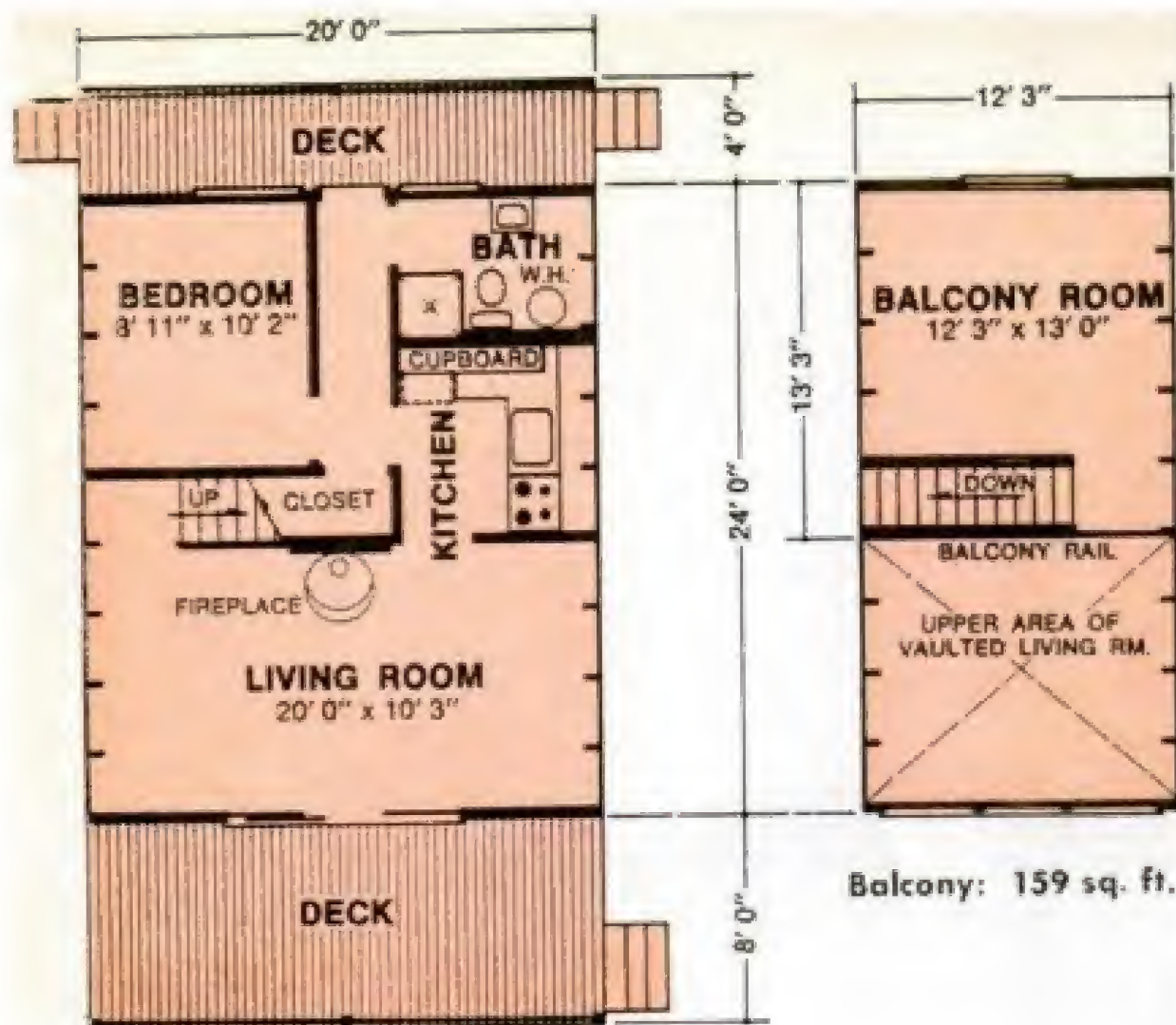
The plans for these homes give you, or your builder, everything you need to do the job and do it right. Being drawn for the do-it-yourself builder, they are more complete than those normally produced for professional contractors.



FEATURING AN OPEN STAIRWAY which leads to a second-level balcony from where one can look out at the vaulted ceiling of a spacious living room, this charming ski lodge has a lot going for it, despite limited floor area. Both levels have roomy decks which run the width of the dwelling. A window wall across the front brings a panoramic view inside and helps create a cheery feeling on gloomy winter days. A built-in eating bar, tucked under the balcony, is part of U-shaped kitchen. This home makes a delightful family-size ski lodge for high, open country. Specify plan No. 5 when ordering



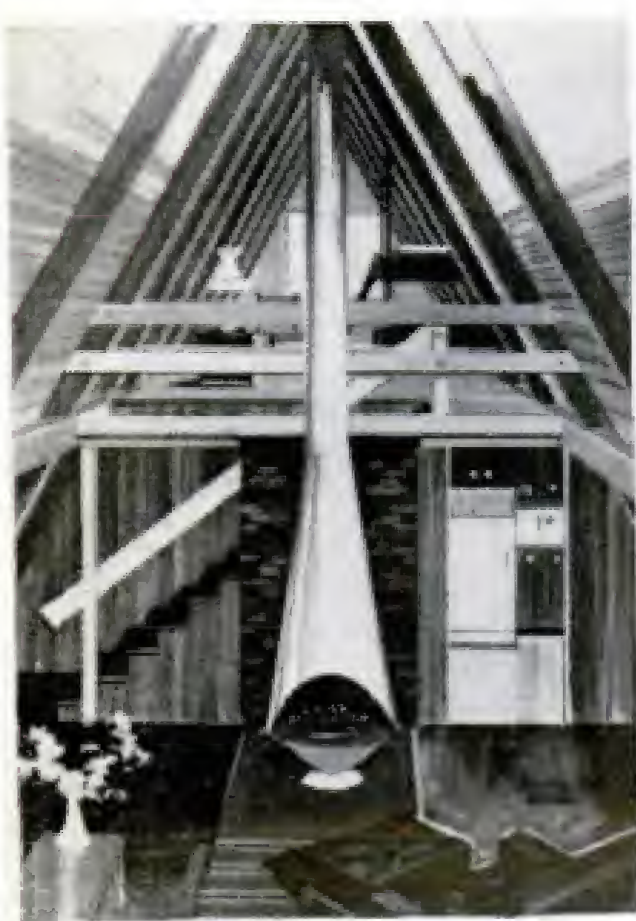
ALTHOUGH THERE ARE ONLY 660 square feet on the first floor and 332 on the second, there are three roomy bedrooms, bath, U-shaped kitchen and spacious living room. There's ample storage, too



Main floor plan: 480 sq. ft.

Classic Design for a Low-Budget A-Frame

SKILLFULLY DETAILED, this version of the once radically different A-frame has been worked out to give you maximum living space and convenience on a minimum building budget. The plans call for a slightly elevated structure with a dramatic glass outlook to bring the whole view inside of the house. The living area is centered around a prefab fireplace and the kitchen area is close by. The plan is laid out for one bedroom down and a spacious sleeping loft up. Texture One-Eleven plywood (panels with deep grooves) is applied with the texture face down to provide a handsome ceiling effect. Both front and back doors are protected and provided with good deck space. Loft overlooks the living room with vaulted ceiling. Closet makes full use of space under stairs. Specify plan APA-112 when ordering.

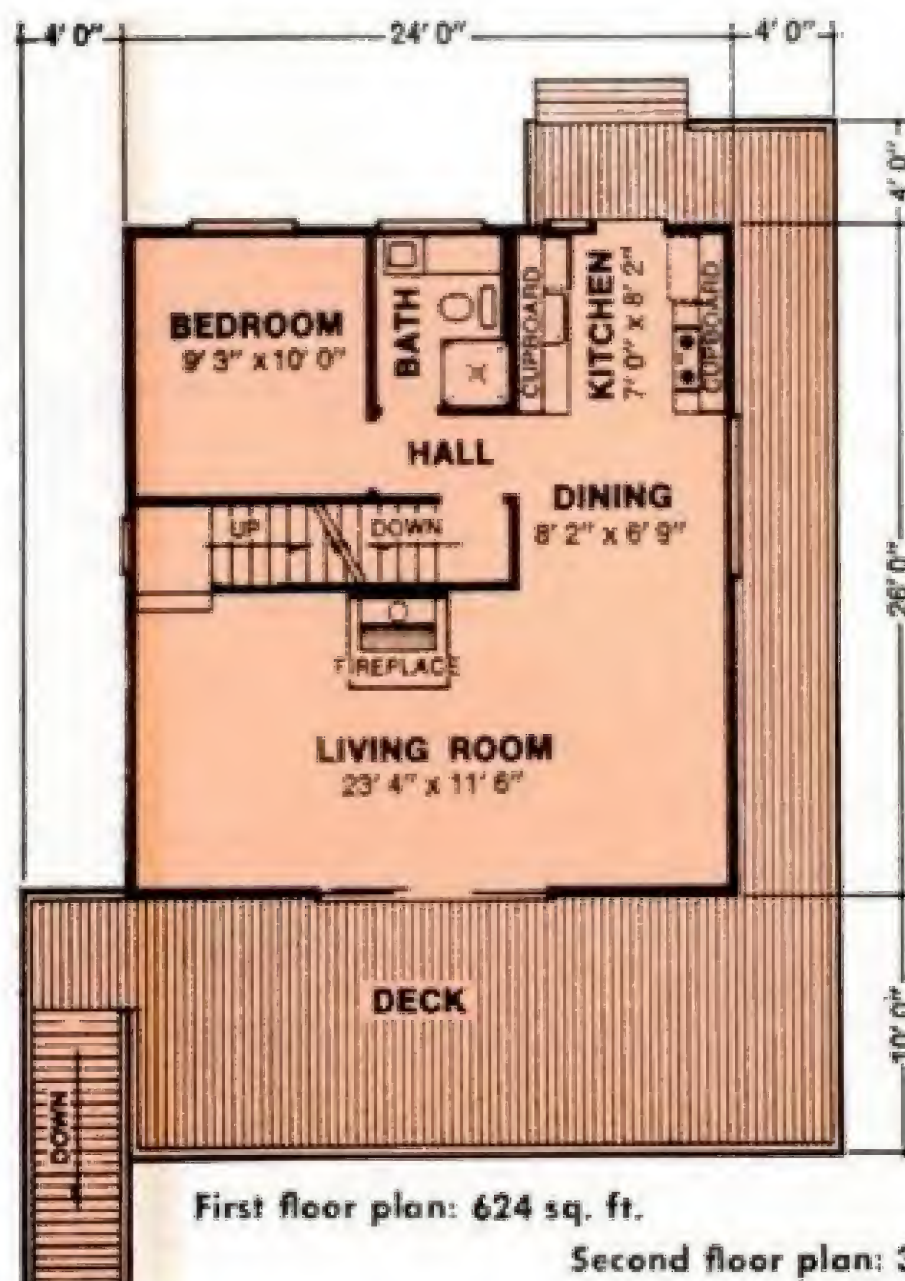




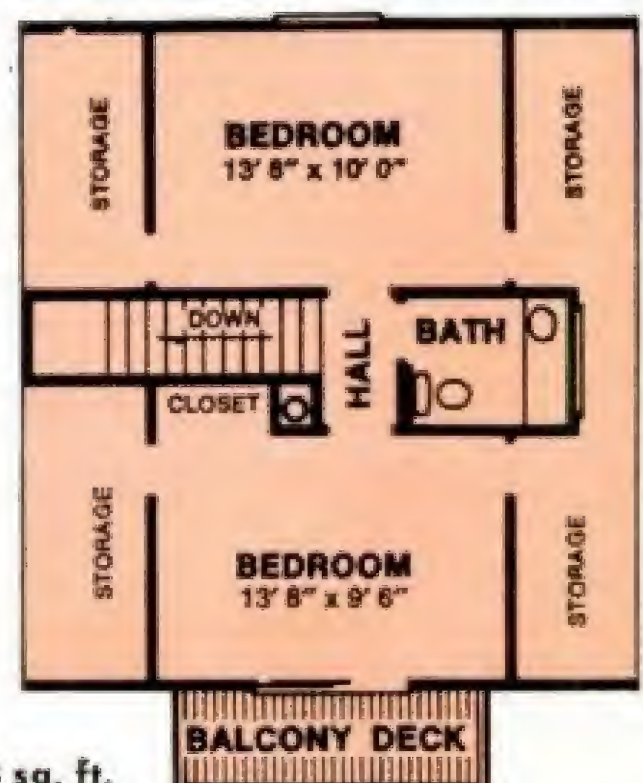
Classic Chalet for the High Country

A BIG DECK and generous roof overhangs give this handsome two-story ski lodge the look of a classic chalet. It gives you one bedroom and bath down, two bedrooms and bath up. The massive fireplace and raised hearth combine with open stairs and exposed beams to create an atmosphere of hearty open-handed living that's in tune with winter. Specify plan APA-103-A.

ALTERNATE PLAN
APA-103-B (with basement) gives you a garage with laundry and storage space beneath the main structure



BUILT-IN CABINET becomes part of stair wall if house has no basement



Wraparound Decks and Generous Overhang

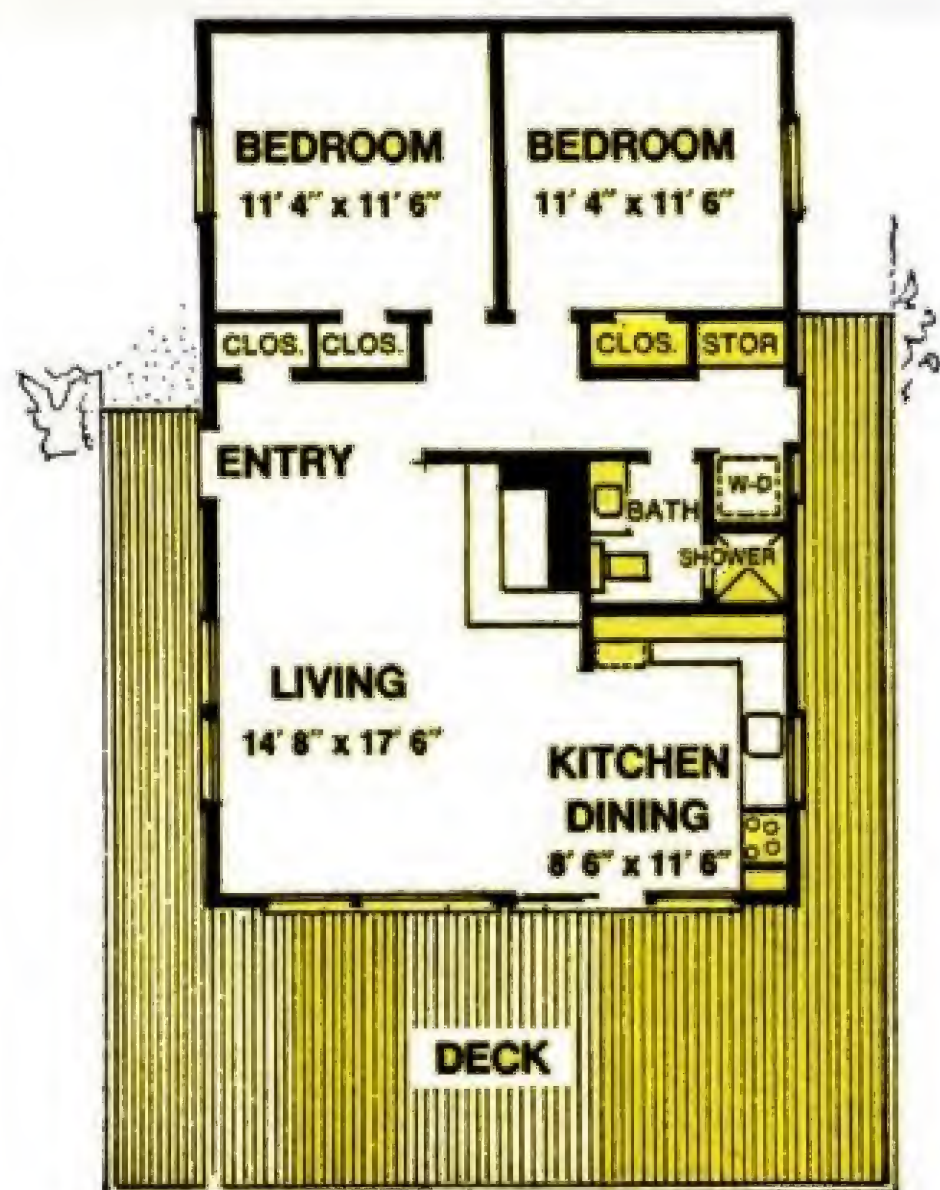


SURROUNDED on three sides by a protected deck to add outdoor living space to its 864 sq. ft. of floor space, this compact ski lodge is perhaps the most popular style of vacation home in America today. It has an excellent traffic pattern in that one can enter the house at three points off the deck, and has an abundance of storage in its foundation area. Its elevated front deck provides shelter for a car or boat.

An L-shaped kitchen merges with the dining area, and an open-end fireplace provides the cozy warmth one needs after a day's run on the slopes. The foundation plan is ideally suited to a sloping site. To obtain blueprints for this ski lodge, specify plan No. 772-1.

HOW TO ORDER PLANS

Plans for any of the four homes can be ordered for \$25 each, or \$35 for four sets of the same plan, from Home Building Plan Service, 2235 N.E. Sandy Blvd., Portland, Ore. 97232. As a rule four sets of plans are needed for permits, financing, cost estimates and construction.



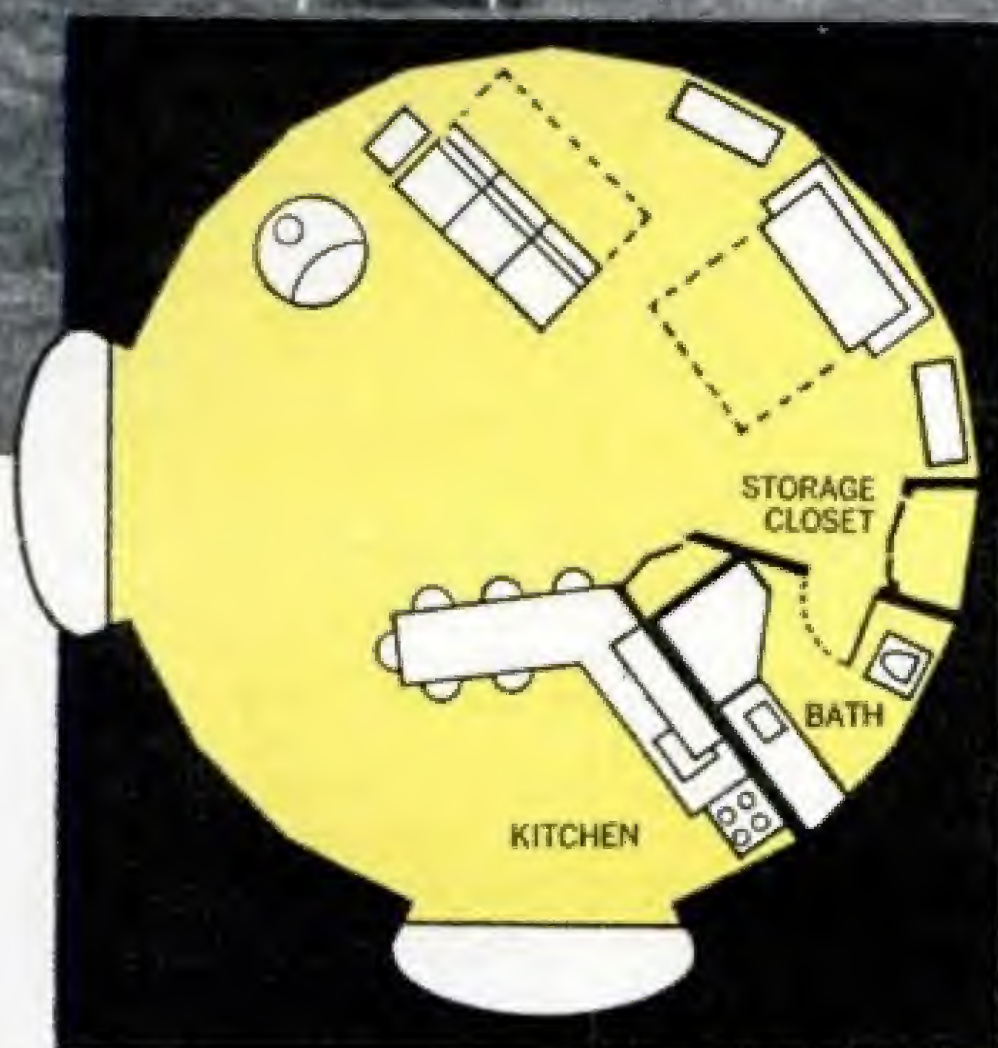
Width: 24 ft.

Depth: 36 ft.

Floor area: 864 sq. ft.

POPULAR MECHANICS

NOW: A VACATION HOME IN 3 HOURS



DESIGNED TO FILL the gap between the tent and the second home, the portable O'Dome shown above is a brightly colored, ellipsoid-shaped building of laminated fiberboard that can be erected in three hours by two people.

Selling for \$2650, it boasts 530 sq. ft. of unobstructed living space (see floor plan left) with room to sleep six comfortably. Weighing less than 1200 lbs., the home can be disassembled and stacked in a space approximately 3x5x16 ft.—small enough to be hauled on a boat trailer.

Lightweight but rugged, each of 18 wall panels snap together in a continuous pattern. Patented strips connect the pie-shaped panels and seal out moisture. The panels, in white, yellow, blue and green, can be ordered in any combination to mix or match as you choose.

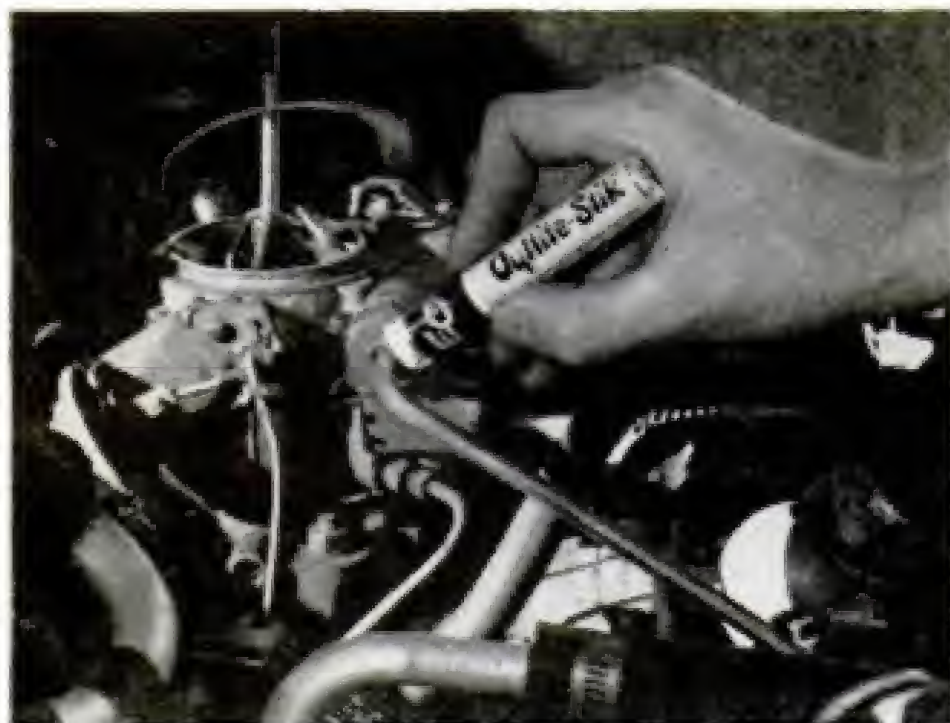
Installation is easy. The first panel is anchored and shaped until others are joined to it; the rest assume proper shape and remain erect during assembly. For information, write Tension Structures, Inc., Box 217, Ann Arbor, Mich. 48107.



PANEL IS RAISED, held in place by tension. With all up, basic unit is 9 ft. high, 26 ft. in diameter

EXCITING NEW PRODUCTS

By CATHERINE BILSKI



WANT TO STOP OIL LEAKS and eliminate messy stains and spots on driveways or garage floors? Oyltite-Stik seals leaks of oil, kerosene, gasoline, battery acids, grease, and so on. According to the manufacturer you just apply Oyltite-Stik to the leak and it stops instantly. No need to drain the system. Priced at \$2 a tube from Ed Cholakian Enterprises, Inc., 8125 Lankershim Blvd., North Hollywood, Calif. 91605.



HERE'S A HANDY CADDY for toting and storing your often abused portable electric drill. The combination case and rack is sturdily constructed, yet lightweight so it can be carried easily from shop to worksite. A storage tray provides space and ready access to drill bits and small wrenches. Caddy can be acquired for \$4.95 from the American Wirecase Corp., 2208 W. Superior St., Chicago, Ill. 60612.



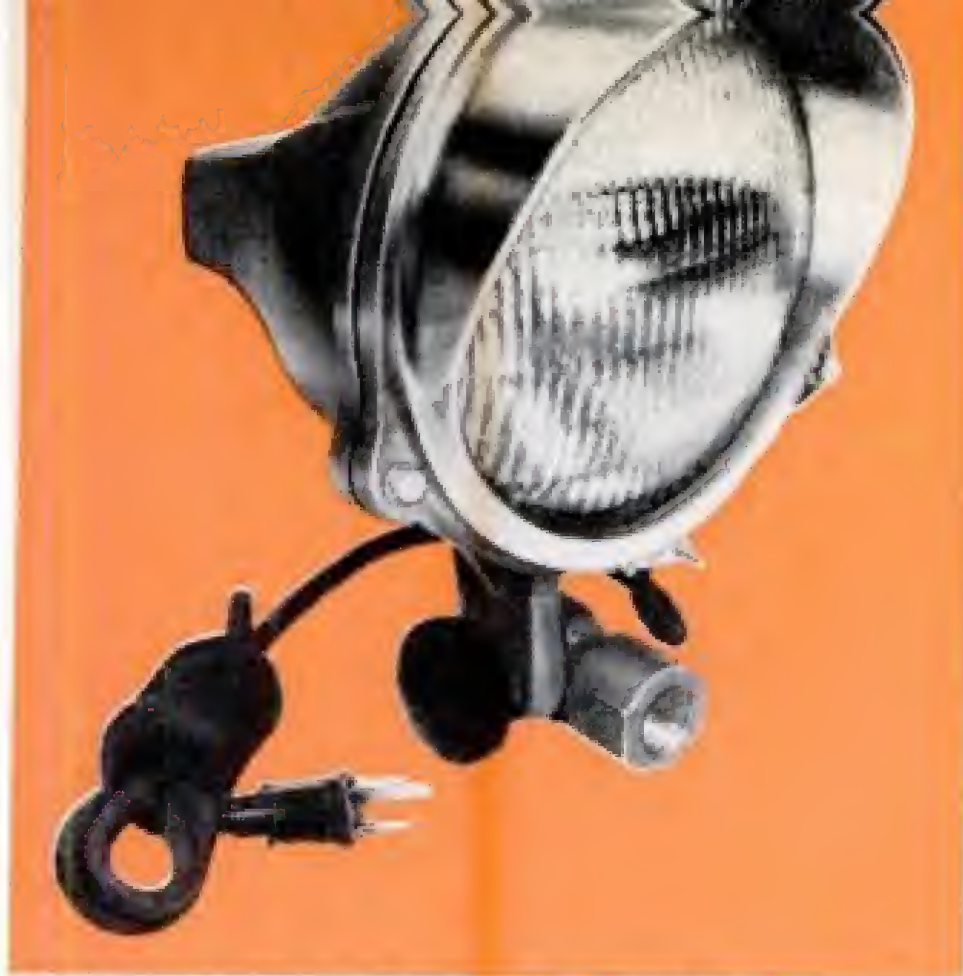
HATE LICKING THOSE STAMPS? Here's a dispenser that will moisten stamps and seal letters, too. The Jiffy Mailer No. 395, made of high-impact styrene plastic, holds a roll of 100 to 500 stamps. Its automatic moistener has a leakproof reservoir and a stainless-steel seal keeps stamps dry until needed. Costs \$3.95 from Lora Dumas, 13292-C Yockey St. No. 14, Garden Grove, Calif.

GET THAT OUTDOOR FIRE GOING in minutes with Char-Lighter, an electric lighter that makes charcoal cooking clean, quick, simple, safe and eliminates lighting fluids, matches—even kindling. Just plug it into any household outlet and place directly on charcoal or briquets. It can also be used to fry eggs and boil water. Priced at \$5.94 postpaid from Flintridge Products Co., 4032 Hampstead Rd., Pasadena, Calif.



NOW YOU CAN APPLY masking tape the way professional painters do. Tape-On is designed to apply the tape to woodwork, wallbase, windows, carpeting, whatever. It can save work on any edging job, and there's no worry about annoying drips, roller splatter or seepage. It also eliminates costly and time-consuming cleanups. Retails for \$8.95 and manufactured by Tape-On Corp., 143 W. Market, Akron, Ohio 44303.





EXTRA LIGHT FOR WORK AREAS, swimming pools, tennis courts, and so on can be yours with a new line of quartz-iodine, prefocused sealed-beam lights. The lights have a life rating in excess of 4000 hours and produce 40 percent more light per rating. Available in 500 and 1000 watts and furnished with a 15-ft. cord and two-prong polarized plug. Made by Generac Corp., Box 8, Waukesha, Wis. 53186.



DOUBLE PICKUP POWER is promised in this new portable vacuum unit designed to clean hard-to-reach areas. Called "The Hippo," the unit features an adapter for use of standard 1 1/4-in. accessories, or you can order special accessories for special jobs. An 18-ft. cord covers lots of ground, making it ideal for home, shop, garage, or even outdoor use. Retailed at \$39.95 by Shop-Vac, Corp., 1 Industrial Rd., Wood-Ridge, N.J.



LOW-COST PROTECTION can be yours with this combination burglar-fire alarm. It's completely self-contained, needs no wiring or special installation, provides 24-hour unattended protection. Instructions and batteries included. Only \$4.95, it's made by Protect-Alarm, Dept. PM, 1746 N. Orange Dr., Hollywood, Calif.

"INSTANT" CLOTHESLINE is easy to assemble and set up. Made of high-quality coated aluminum, it goes up quickly when needed, comes down just as quickly, is easily stored. Called "Rigidrig," it's available in single (\$23.95) and double (\$39.95) units. Made by Rigidrig, 250 W. Main St., Evansville, Wis. 53536.



FIX CRACKS FOR GOOD with Krack-Kote wall and ceiling repair kit. Permanently repairs cracks because it bridges instead of fills them. Tuffglass fabric embeds in mastic coat to produce noncracking joint. Trial kit costs \$3.99, economy kit, \$6.99, both post-paid from Collectors Unlimited, Dept. K-183, Box 268, Fair Lawn, N.J.

How to Install a Wall Safe



Photos by Robert Borst

Without a home safe to go with your bank safety-deposit box, you are only half safe in protecting your valuables

By WAYNE C. LECKEY, Home and Shop Editor

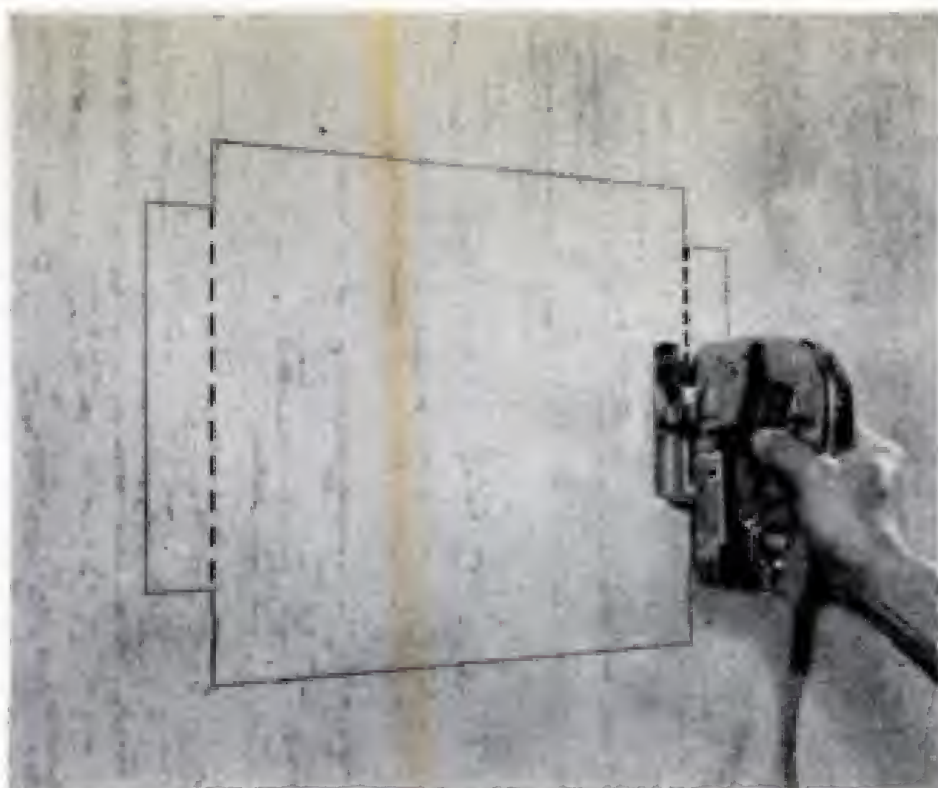
EVER STOP TO THINK what a job it would be to replace your birth certificate, insurance policies, deeds, bonds and other vital records should you have a fire? What about jewelry and money?

With such valuables kept safe from both fire and theft in your own "safe-deposit box" in a wall of your home, you'll not only have the peace of mind of knowing they're secure, but the convenience of having them always at hand—not just during banking hours.

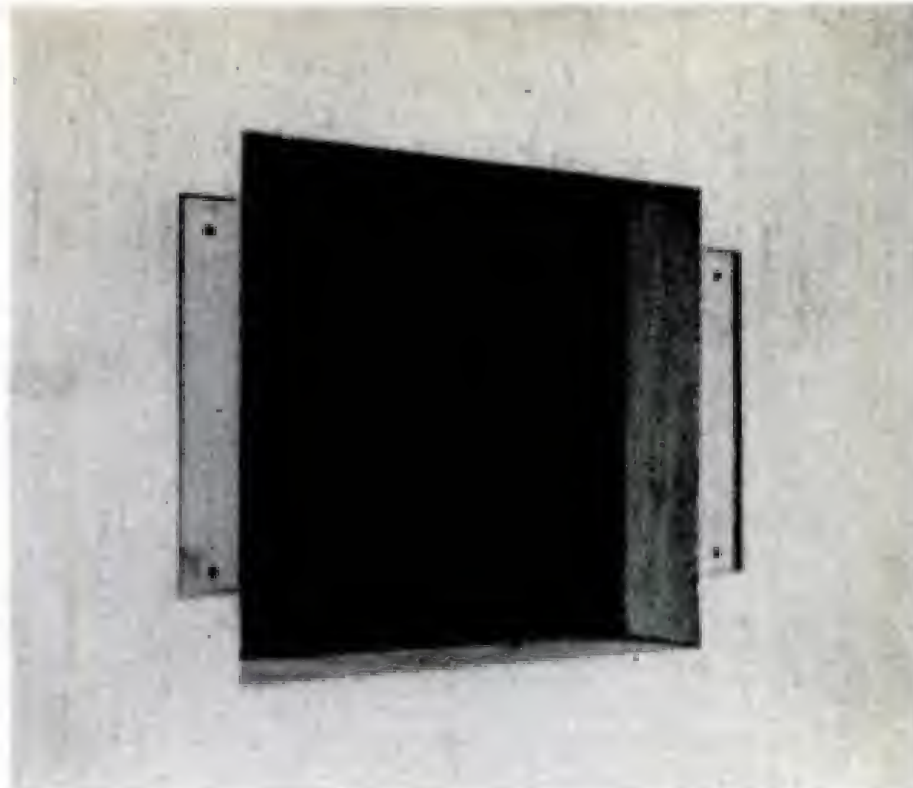
As pointed out by the Safe Manufacturers National Assn., a home safe provides several



PICTURE HINGED TO WALL conceals safe from view, thus permits use of convenient location



1 **SABRE SAW** makes quick work of sawing through plaster to cut 13 x 14½-in. opening



2 **RECESSES ARE CUT** in plaster over studs to accommodate safe's bolting flanges at sides



3 **SAFE IS SHOVED** in opening until flanges are seated. Pilot holes for bolts are made in studs



4 **FOUR LAGSCREWS** (¼ x 2-in.) anchor safe. Flange recesses are filled to hide screw heads

National Assn., a home safe provides several advantages for the homeowner:

- **Security.** Should a fire destroy his home, he knows that his family records will be protected.

- **Convenience.** The home safe is a general, single-source repository for all records and valuables.

- **Protection.** The danger of theft is minimized since the amateur burglar is generally prevented from entering the safe.

- **Accessibility.** Daily access to the safe enables the homeowner to protect important incoming receipts and records on the day of arrival.

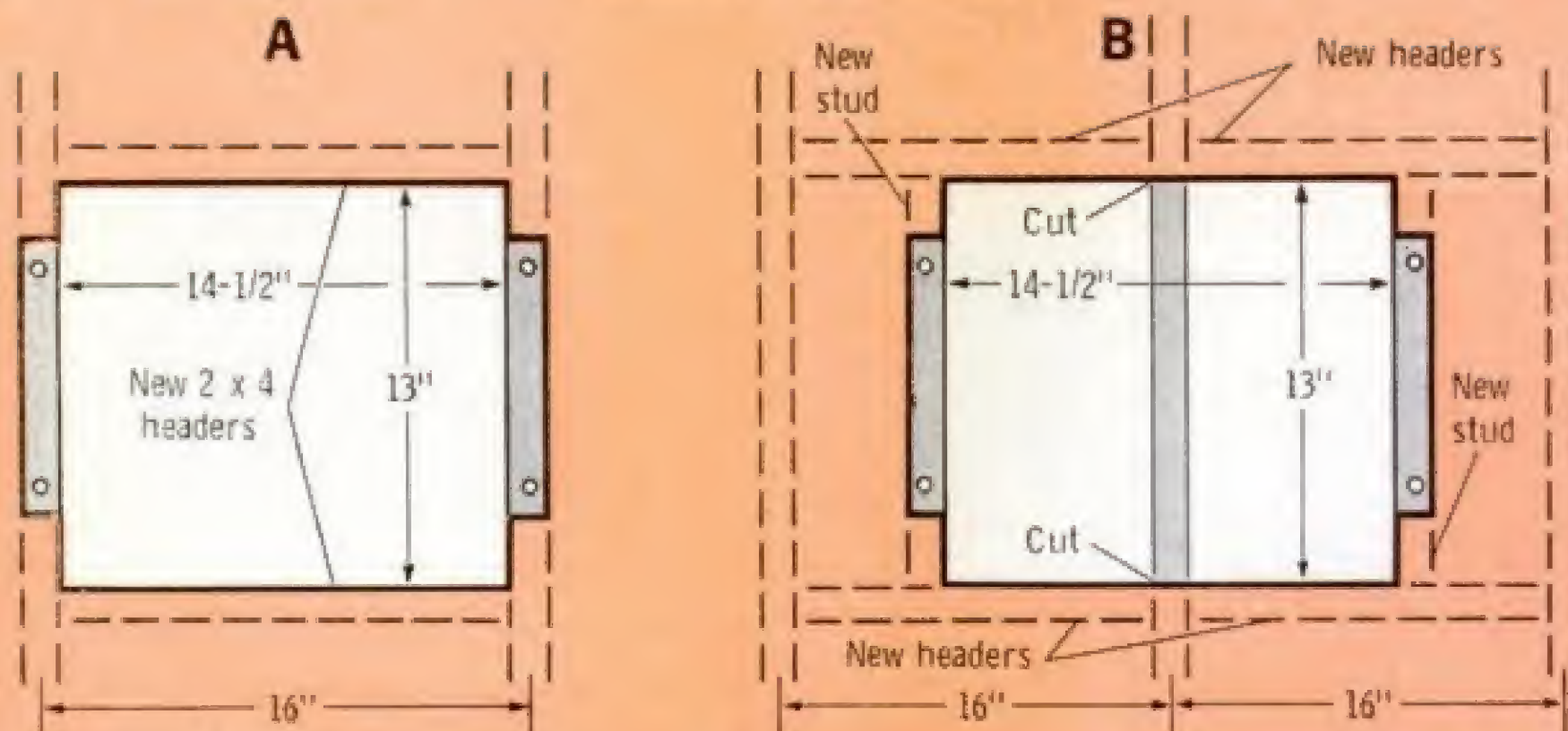
- **Job protection.** Many businessmen take work home nights and weekends. Many times, one-of-a-kind records travel home in the briefcase. To assure their protec-

tion, the executive can store these company records in the home safe for added security.

- **Jewelry safety.** For the home without a money safe designed to hold valuables other than records and documents, the home safe is a stop-gap security measure until infrequently used jewelry is returned to the bank vault.

The Meilink Hercules vault shown here is designed to fit flush in the wall even though it has a three-tumbler combination lock. Thus the safe can be concealed by a wall picture or mirror, and only you know where it is. Inside it measures 9½ in. high, 11 in. wide and 8⅜ in. deep, roomy enough to hold all your documents and valuables. It weighs 80 lbs., costs about \$50 f.o.b. A thinner one is

FRAMING THE OPENING



only 4³/₈ in. deep and weighs 60 pounds.

It's double-steel walls are thoroughly insulated to withstand a temperature up to 1700° F. for a period of one hour. Two ½-in. steel operating bolts on one side of the door, plus two stationary bolts on the hinge side, provide added security. Inside, there is a shelf and a flock lining.

The safe's four-number combination lock is registered at the factory. Should you forget or lose the combination, the factory will disclose it only to the registered owner of the safe.

Installation is made on an inside wall, preferably one which is backed by a closet. This way the safe can stick through the wall without protruding into another room. The least installation work is required when the safe is located between two existing studs as shown in detail A above. Here you need only add a 2x4 header at top and bottom of the opening.

Where you wish to center the safe on a wall, you may find the opening straddles a

stud as shown in Detail B. When this happens, the stud must be sawed off even with the opening and new fill-in studs installed along each side for bolting the safe. These are cut to wedge and glue in place between headers, then nails are driven through the plaster or drywall, as the case may be, to provide a rigid framework.

Hidden studs in the wall can be located by tapping the wall lightly and noting a solid sound. Since most studs are located 16 in. on centers, and since the safe is made to fit between two studs, you simply cut the plaster away between the studs. A sabre saw is a handy tool to use for cutting through plaster or drywall, although a handsaw will let you pass through both sides of the wall at one time. Try to keep sawing at right angles to the wall so that both openings will be the same size. This is particularly important when making the horizontal cuts; the studs will guide you when making the vertical ones.

A sharp chisel is used to chop away the plaster when cutting the recesses. The plaster or drywall, incidentally, should be a minimum of ½ in. thick to bring the safe's tumbler flush with the wall.

The safe is bolted to the studs with four lagscrews inserted through flanges welded to each side and recesses are made in the plaster over the studs to accommodate the flanges. Once the bolts are in place, the recesses are patched with a spackling compound or filled in with pieces of drywall, to make the bolt heads inaccessible. The patched areas are then painted.

★★★

HOME SAFE MANUFACTURERS

Diebold Inc.
828 Mulberry Rd. S.E.
Canton, Ohio.

Gary Safe Co.
306 9th Ave.
City of Industry, Calif.

Meilink Steel Safe Co.
Oakwood & Dawson Aves.
Toledo, Ohio.

Mosler Safe Co.
1561 Grand Blvd.
Hamilton, Ohio.

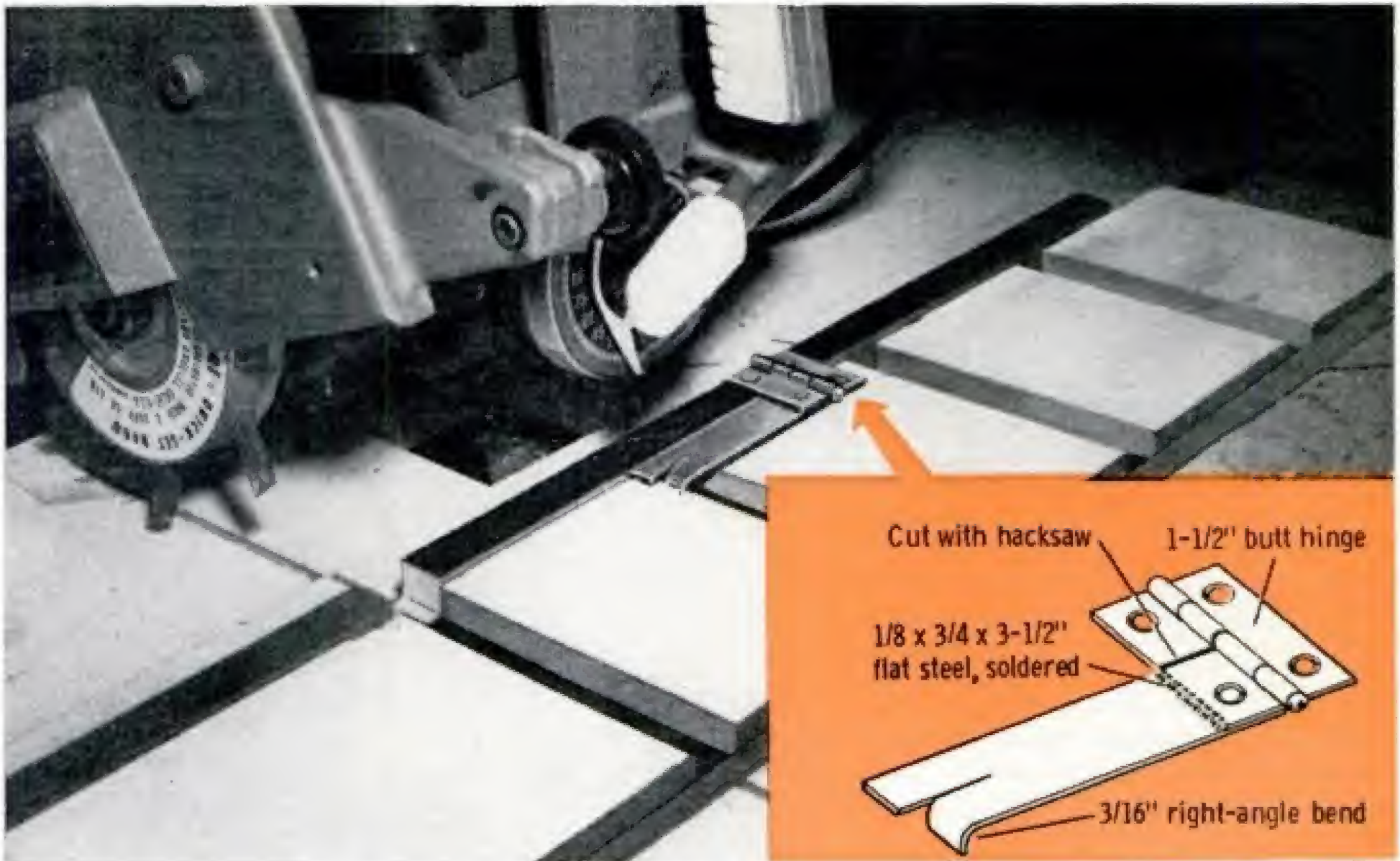
Protectall Safes
1957 Grand Blvd.
Hamilton, Ohio.

Murphy Mfg. Co.
128 E. Main
Louisville, Ky.

Schwab Safe Co., Inc.
Lafayette, Ind. 47902

York Safe Lock Co
818 Mulberry Rd., S.E.
Canton, Ohio.

Make This Hinged Fixture for Your Radial Saw



No radial-arm saw should be without this combination dado spacer and cutoff stop. It's the handiest thing for insuring equal spacing of shelf dados and cutting pieces to duplicate length. Permanently attached to the top of the wood fence, it's set to the desired spacing by sliding the fence in its slot. It flips over when not in use; if in the way when you're sawing 2-in. stock, turn the fence end for end.

When measuring for the first dado, the fixture is set against the end of the work, not the table. Otherwise the slight arc of

the pivoting fixture is enough to throw off the measurement.

The fixture is made from a 1½-in. loose-pin butt hinge. One leaf is hacksawed as shown and a metal arm is soldered to it. The end of the arm also is hacksawed and bent down to produce a lip. The hinge is screwed to the fence so the fixture overhangs the edge. This lets it drop down into the dado or against the saw table for cutoff work. When it's flipped back, 1-in. stock can still pass under it freely.—William Waggoner

Pencil eraser starts nut

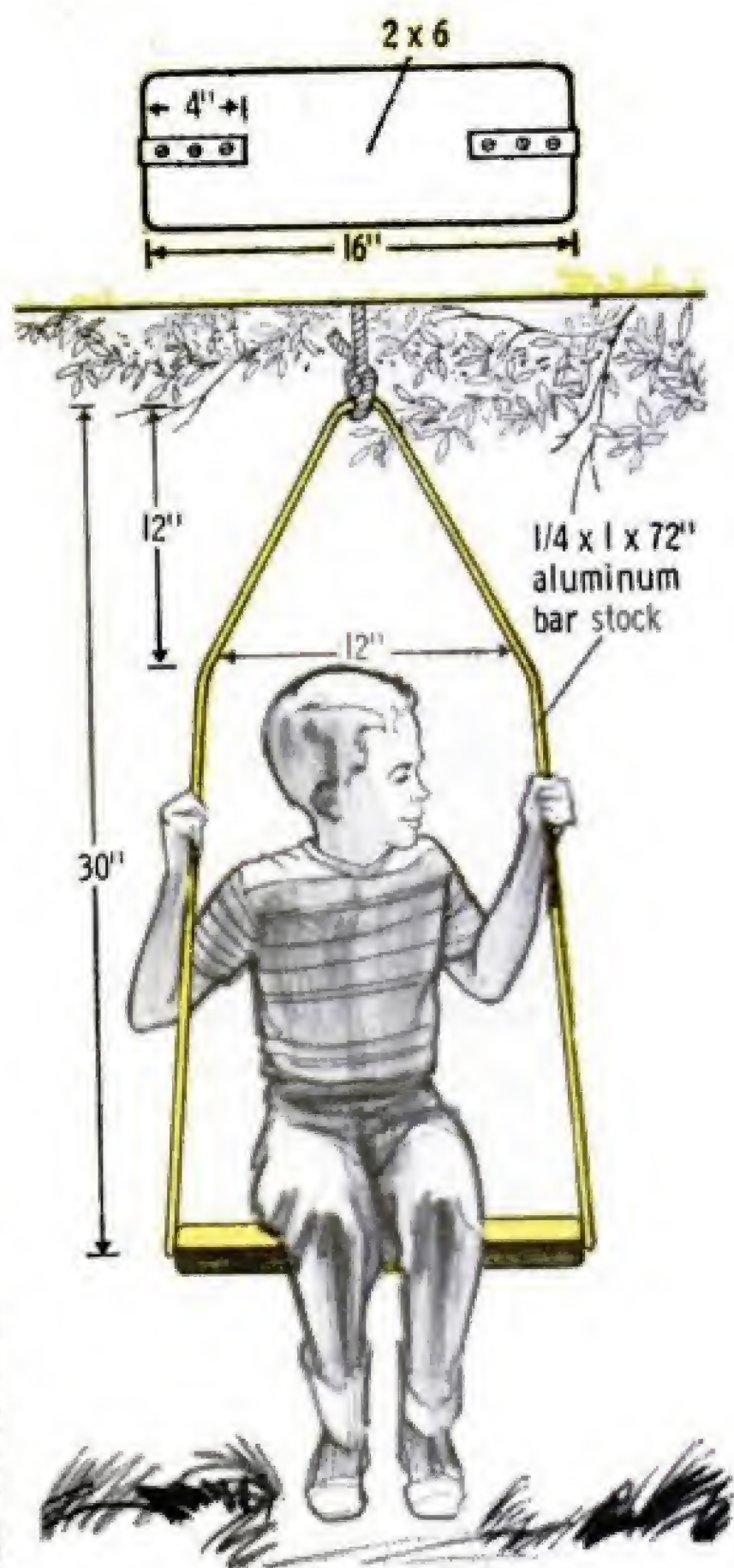
If you are faced with starting a nut on the end of a bolt in a counterbored hole, you can do it with a pencil eraser. Hold it so it positions the nut squarely on the bolt and turn the pencil as you bear down. Friction will turn the nut. Once the nut catches hold, you can draw it up tight by jamming a screwdriver against the nut and the side of the hole and turning the bolt head with a second screwdriver. Ordinarily a regular nut driver is used to engage the nut but this special tool is not always at hand. In place of a pencil, a piece of double-backed tape on the end of a dowel would do.—Walter E. Burton



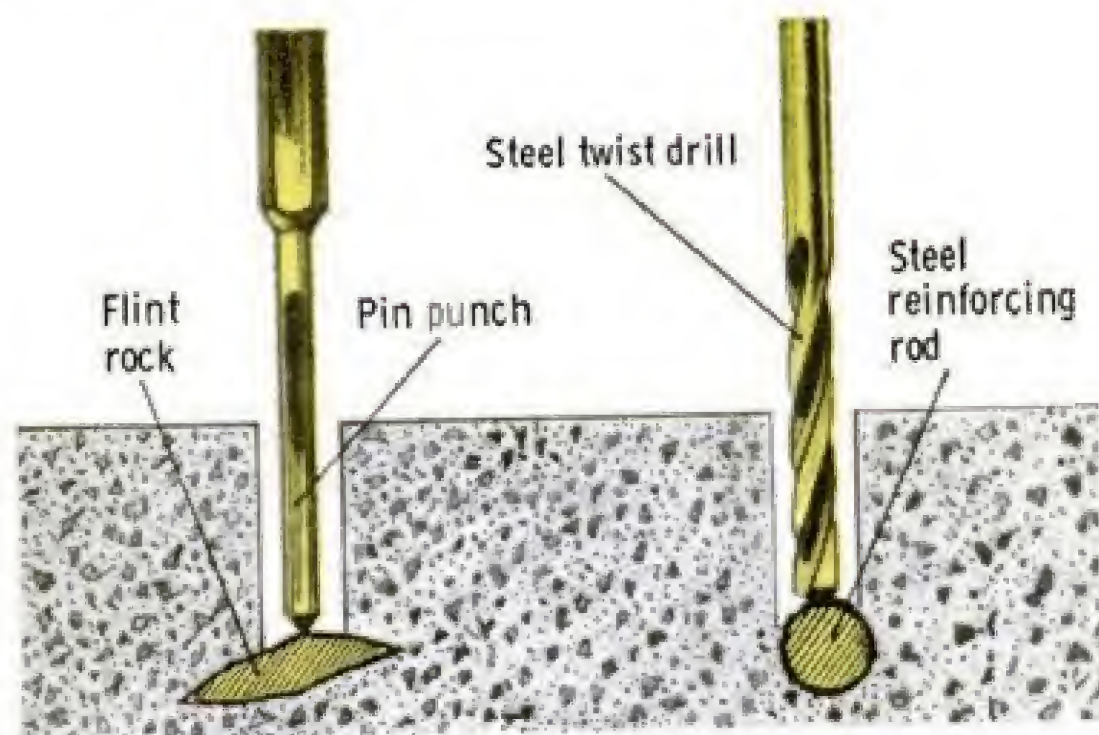
Solving home problems



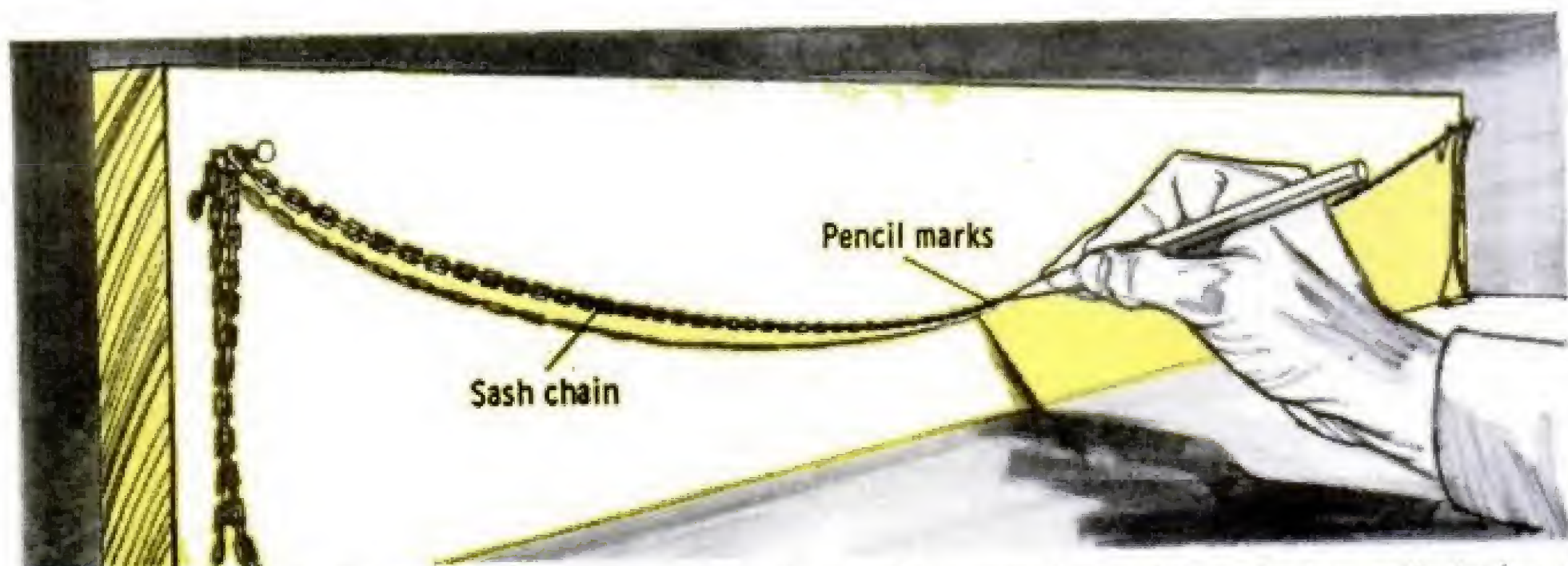
POTTED PLANTS WON'T TIP in a strong wind when set around a patio or grave if you use wire anchors cut from coathangers. Hook over pot, push wire in ground.—J. H. Lewis



LIKE A TIRE SWING, this one-rope adaptation is more fun than two-rope one. Bend yoke from aluminum and add wood seat.—Harold Miglin

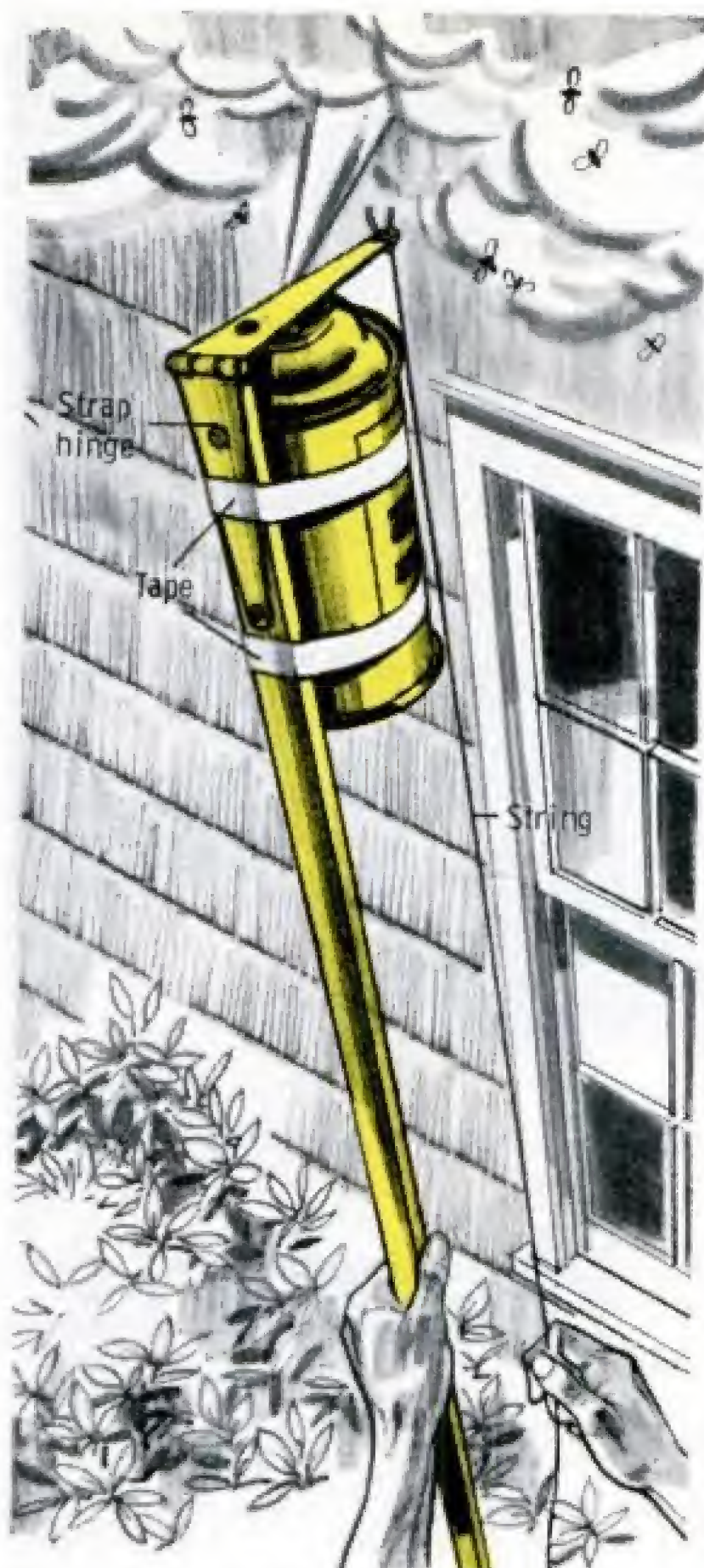


NEXT TIME FLINT ROCK IS IN PATH of your masonry drill, stop drilling and use drift pin to break it. If you hit steel reinforcing rod, switch to twist drill.—George B. Domenico

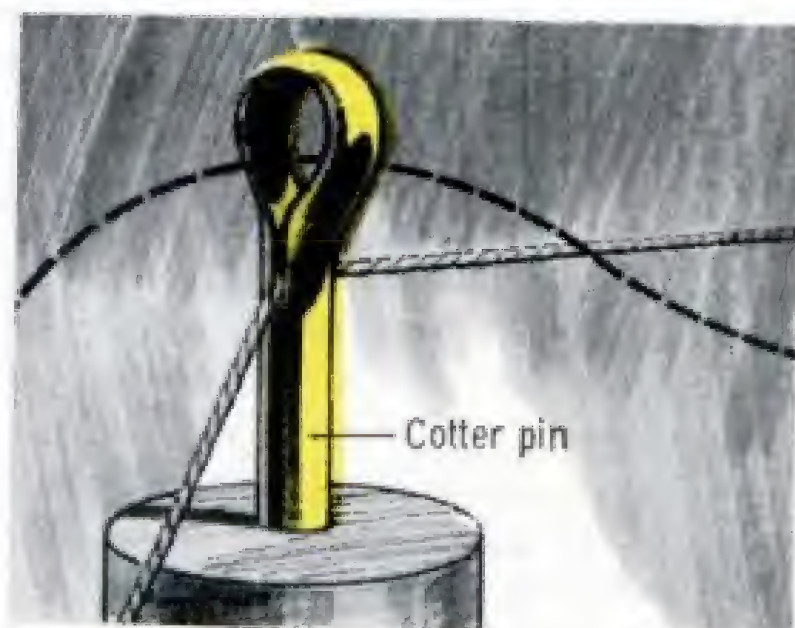


LENGTH OF SASH CHAIN makes simple compass for drawing large arc. Suspend chain by two nails, let hang free and make a dot every four or five links. Then connect dots to form unbroken line.—Victor H. Lamoy

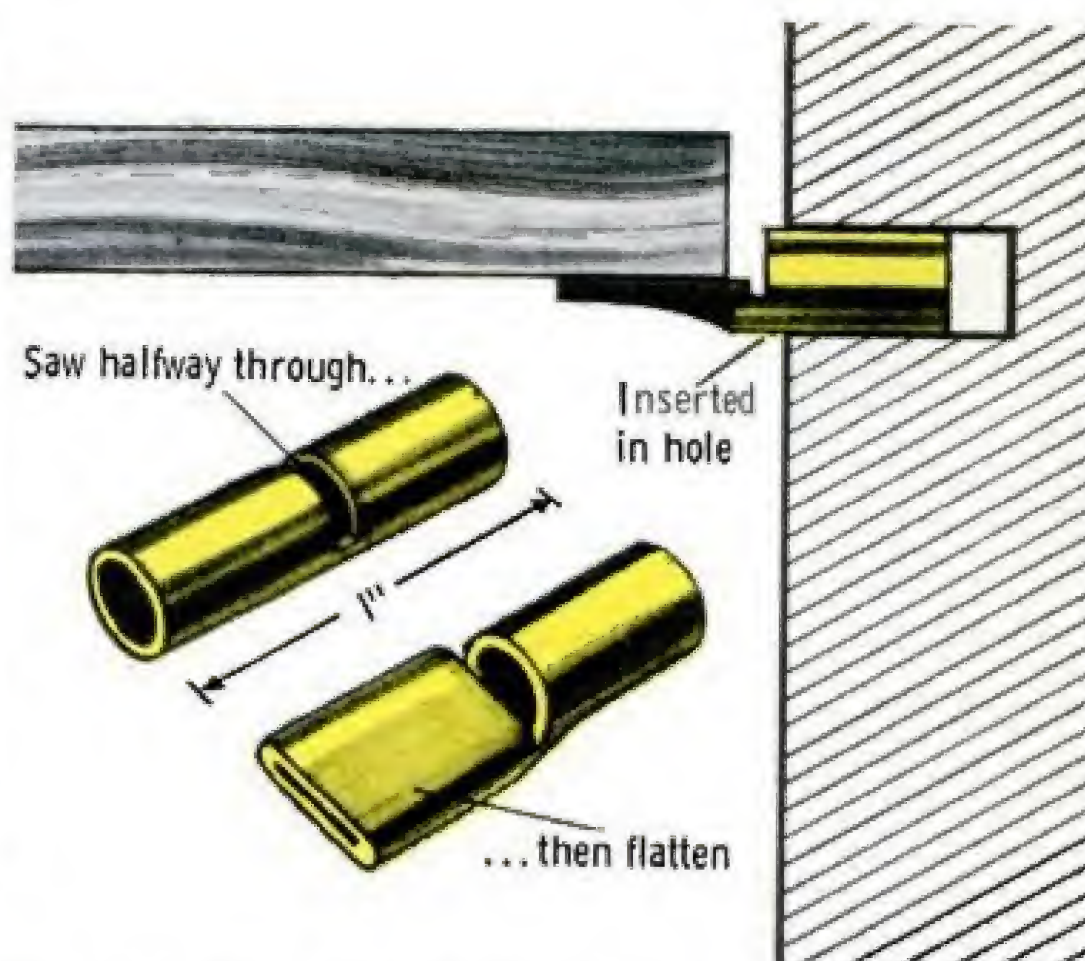
POPULAR MECHANICS



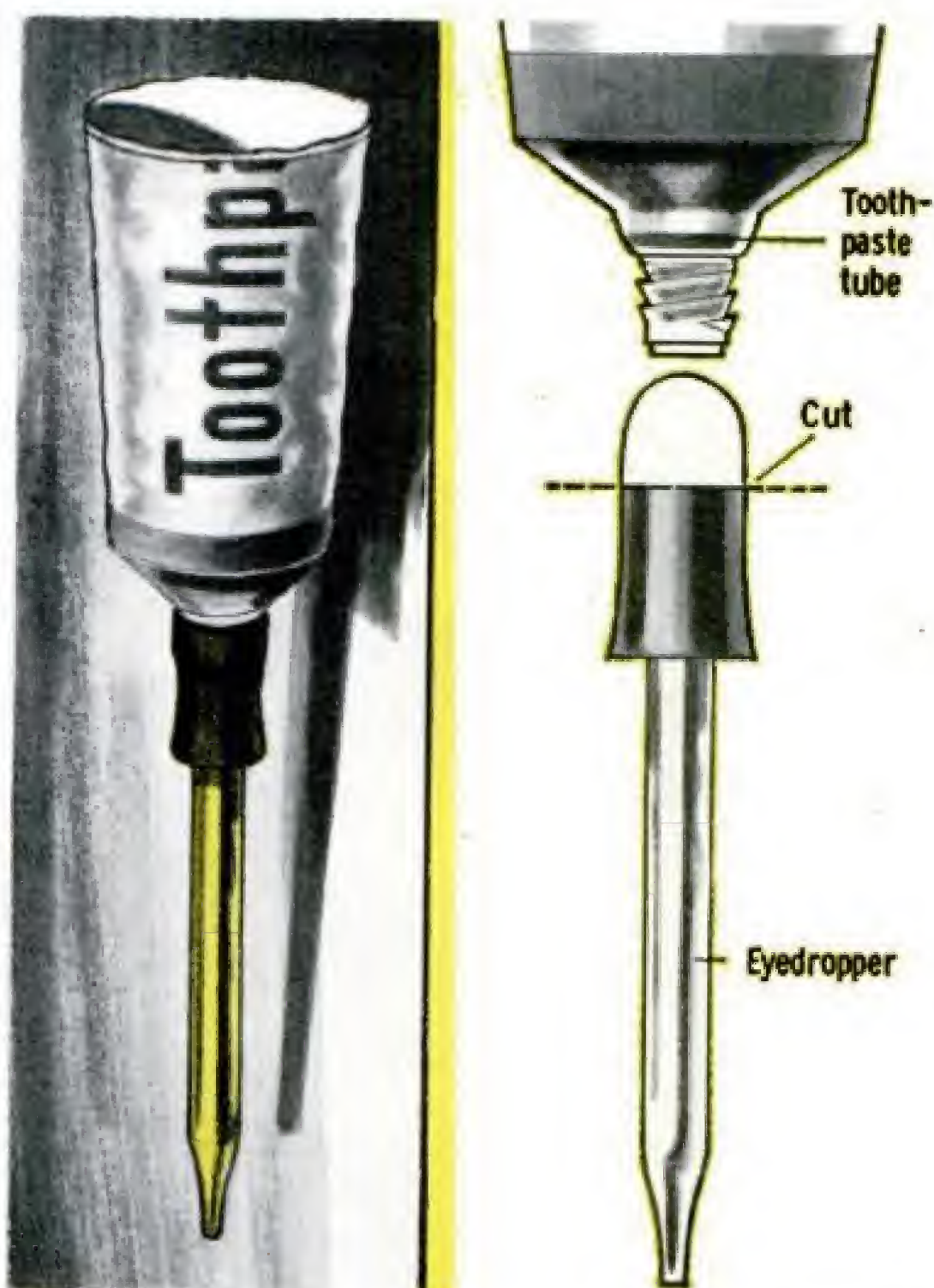
TO REACH HORNET'S NEST under eave attach strap hinge and spray can to pole. String to hinge runs spray.—B. R. Alexander



QUICK-RELEASE STRING HOLDER is a cotter pin in end of stake. String wedges between pin, quick yank pulls it free.—Daniel Bousha



YOU CAN MAKE SHELF SUPPORTS by the dozen if you cut $\frac{1}{4}$ -in. tubing in 1-in. lengths, saw halfway through and flatten with hammer. Round end is stuck in blind hole.—Daniel Bousha



TO FILL SMALL-MOUTH BOTTLE, eyedropper and empty toothpaste tube make perfect funnel. Cut rubber end off dropper and force it over threaded end of tube.—Joseph Braunstein



CLEARING THE AIR in winter is a problem. Opening a window gives chilly blasts and causes heat loss

Update Your Heating

A fresh-air intake that you can install yourself makes stuffy air a thing of the past.



FRESH-AIR UNIT comes complete with bug screen and a damper that's located in the 6-in. round pipe.

IF YOUR HOME is equipped with a ducted central heating system and you are just plain tired of opening windows and living with drafts every time you want fresh air, you're in luck. New from the Lennox Corp. is a fresh-air intake that installs quickly and inexpensively. And, happily, it makes the which-window-to-use game a thing of the past.

Called Living Air Inlet, the unit draws fresh (outdoor) air into the system and pipes it directly into the inlet or return-air side of the warm-air system. A manually operated damper lets you adjust the flow of outside air to suit your comfort. All outside air is filtered and conditioned (heated or cooled) before it enters the living areas of the home.

Construction techniques in the past produced houses that were pretty leaky. Windows were loose in their frames; weatherstripping was expensive, thus not widely used, and installation of adequate vapor barriers was practically unknown. Additionally, walls, ceilings and floors were comparatively porous, so outside air could move through the home by infiltration. In effect, there was enough "leakage" to keep the inside air satisfactorily fresh.

Today's construction methods have changed the picture. Windows and doors are factory-tight; well-designed weatherstrips are universal; and modern insulation, if properly installed, provides an airtight vapor barrier. Thus, to replace stale air, you must open windows. And that means drafts and loss of heat which costs you money.

A fresh-air inlet solves those problems by bringing fresh air into your heating/cooling unit. Additionally, through the constant supply of outdoor air, a slight positive pressure is created in the home. The maker claims this tends to counteract normal infiltration.

The beauty of the unit is that its use is not restricted to new construction. A 6-

in.-diameter hole is required to install the intake through an exterior wall to the outside. Then, you simply caulk all around the pipe in order to prevent rain seepage and connect the pipe to the nearest return-air duct (or drop) in your warm-air heating system.

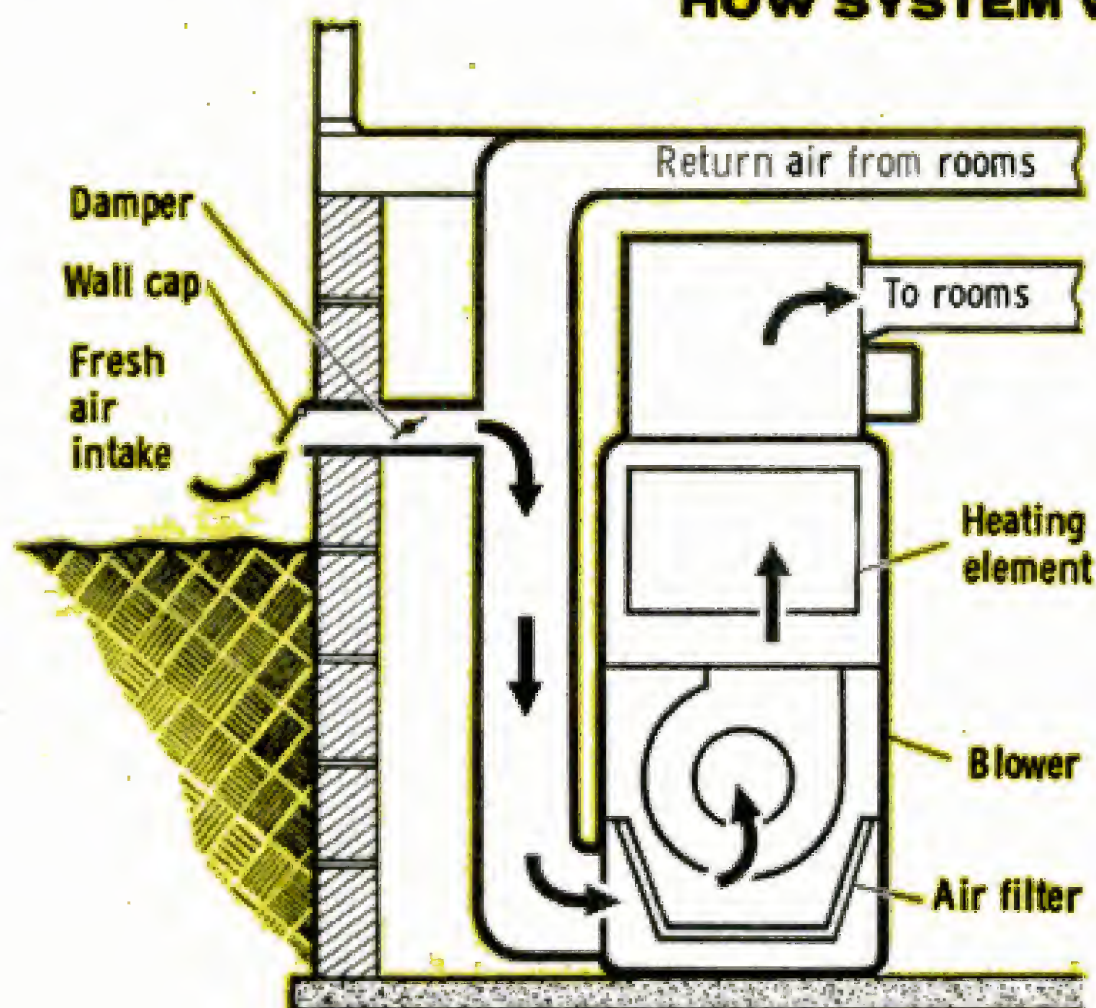
Lennox recommends that warm-air furnace blowers should be set to operate constantly, rather than be controlled by the "on-off" operation that is usually used. With the fan operating constantly you will receive full-time benefits from your warm-air furnace when combined with the fresh-air inlet.

Keep in mind that outside air can only be effectively introduced into your home if you have a ducted central heating system. A nonducted system (radiators, for example) cannot carry outside fresh air at all. Radiators simply heat air within each room; there is no mixing of the air drawn because it is not drawn back from all of the rooms to one central point for filtering.

Price for all this luxury is under \$10 if you install the intake yourself. For buying information, contact the certified Lennox dealer nearest you. He's listed in the Yellow Pages. ★★★

System With Fresh Air

HOW SYSTEM WORKS



Positive pressure created combats infiltration, eliminates drafts through walls

◀ Fresh air is introduced directly into return duct, filtered clean, conditioned and ducted to living area

New tools you should know about



Do-everything cutting tool

Here's a tool that handles like a conventional plane or file and boasts a 10-sq.-in. cutting surface. Dubbed Versaplane, it will cut hard and soft wood, brass, zinc and other alloys; bevel glass and marble, and sharpen axes, scythes and mower blades. At hardware stores, \$9. Made by Great Neck Saw Mfrs., Mineola, N.Y. 11502.



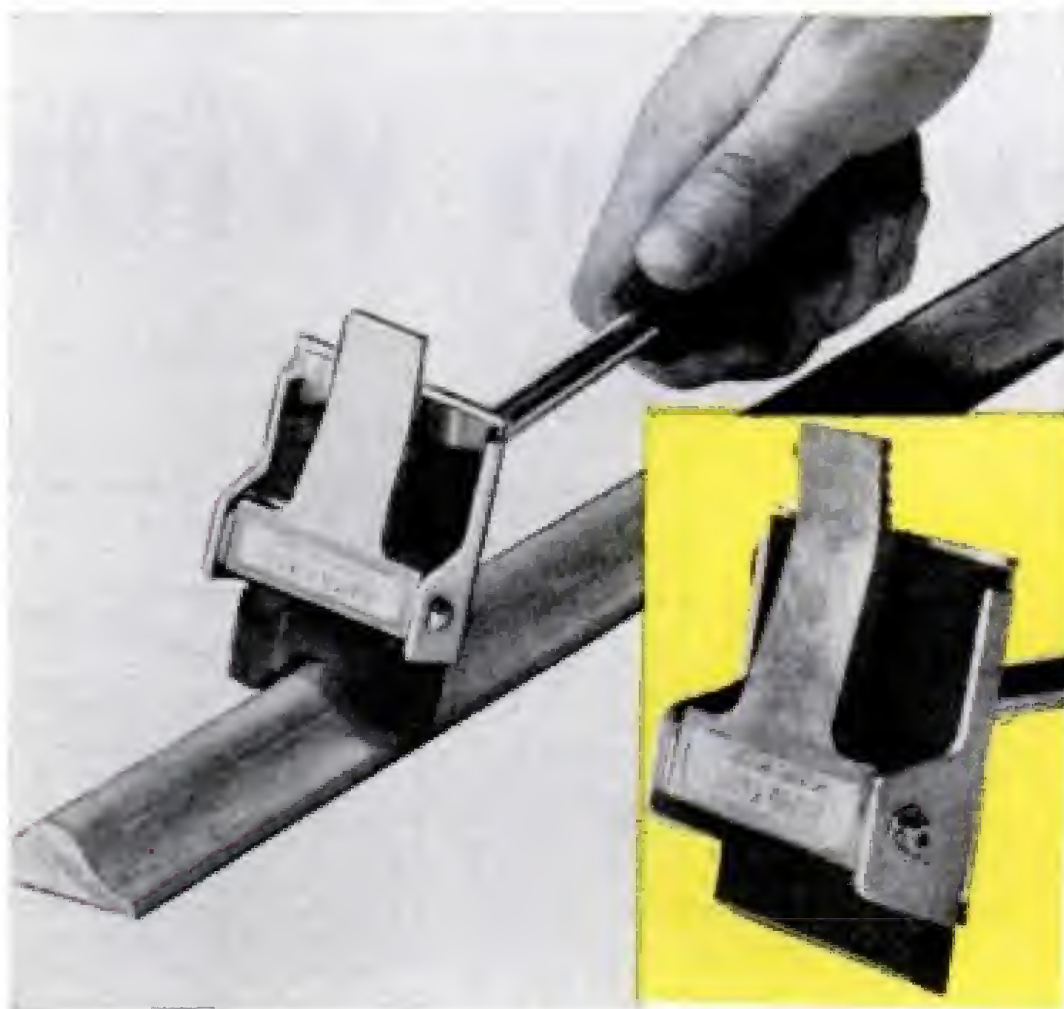
Low-cost tubing bender

Fast and easy to use without kinking is the Tube Bender 541A. Tubing up to 5/16 in. in diameter is simply slipped under the bender's flange and bent around the circle. For right-hand bends, the procedure is reversed. Sold through hardware stores for \$1.65. Kastar, Inc., Station Rd., Bellport, N.Y. 11713.



Midget plier set for close-in work

Five-piece electrical plier assortment (above) consists of diagonal cutter, end nippers, and needle, flat and round-nose pliers. The 4 1/2-in.-long pliers of high-grade alloy steel are drop-forged, heat-treated and fitted with oil and chemical-resistant vinyl grips. Plier set No. PT-1160 in the Blackhawk line is priced at \$19.50. New Britain Machine Co., New Britain, Conn., is the maker.



Scraper features form-fitting cutters

Paint can be easily scraped from contours such as window frames, boat hulls and moldings with this tool called Rapid-Form, which has tempered steel blades fitted into its adjustable head. You simply release the clamp-lock, position the blades against the form to be scraped and relock the blades. Priced at \$7.95, it's made by Crystal Metal Products Co., Inc., Philadelphia, Pa. 19134.

HINTS

FROM READERS



Hook saves drill

When working with an electric drill on a stepladder, it's easy to knock the tool off and cause expensive damage. To prevent this from happening, I fastened an ordinary coat hook to the ladder to serve as a tool hook. If you add an extra hook, other power tools can be hung with a short piece of string or wire.—Ken Patterson



No-cost nail carrier

Here's a versatile nail carrier that can be toted right to the job, even when working on a ladder. To make it, cut two half-gallon milk cartons as shown above, then simply staple the tops together. The carrier can be hung over the rung of a ladder, or placed on the floor or bench where you are working.

—Ken Patterson



Toggle-switch safety

An exposed toggle switch is subject to damage and breakage and, if accidentally flicked on, can cause injury by a power tool. To minimize these hazards, I installed a drawer pull over the switch. This requires reaching under the handle to push the switch, but the pull now takes the brunt of any blows.—Allen Wilks

NEXT MONTH IN SHOP AND CRAFTS

BUILD A CHRISTMAS GREETING FOR YOUR LAWN. Designed especially for our readers, it's motorized and gaily decorated with three lovable Disney characters. Sure to draw raves from the neighbors, it may even cop a prize in an outdoor decorating contest. Complete plans, including Project-A-Plan slides which make it a snap to copy the art, are in the November issue.

WOODTURNING FUN FOR BEGINNERS. Here's the answer for the man who wants to try his hand at woodturning without investing a lot of money. Using a low-cost lathe, you can experience the same enjoyment that you would get working with a more expensive tool. Packed with useful woodturning information and tips, this article will help experienced, as well as beginning, lathe buffs. In *PM* next month.

WHAT YOU SHOULD KNOW ABOUT HOME BURGLAR ALARMS. High, low and middle-income families have one thing in common: they are all fair game for burglars. However, you can do something about protecting your family and property. Here's a round-up of foolproof systems available for burglarproofing your home and how to install them—in the November issue of *PM*.

HOW TO ANTIQUE YOUR OWN BEAMS. If you like the look but not the price of hand-hewn beams, why not add the ancient art of adzing to your woodworking skills? Using a "homemade" adz, you can turn out finished beams that will match those that you've seen in restored Early American homes. Learn more about this fascinating woodworking technique in *PM* next month.

How to 'Plane' On a Lathe

The number of tricks you can perform on a machine lathe seems endless. Here's another you can add to your bag



By **WALTER E. BURTON**
Technical Art by Fred Wolff

NOVEL DISH has conically planed legs. Text gives technique

YOU DON'T HAVE TO OWN a planer, shaper and milling machine to do flat and conic surfacing. Using a machine lathe and the proper techniques you can:

- "Plane" a flat surface on a chunk of steel.
- Square up a block or bar, or simply reduce its thickness.
- Convert a rod into a gouge-like tool.
- Shape a rod end to fit the contour of a cone.

To machine a flat surface, the workpiece is clamped in a chuck or bolted to a faceplate, and the tool cross-fed. Depth of cut is determined by carriage movement or by the compound slide while the carriage remains stationary.

Often, when a rectangular or nonround area is to be machined, the cutting action is intermittent. The tool shaves a chip, then traverses empty space until it con-

tacts the workpiece again. Because of this intermittent action, a too-deep bite by the cutting tool puts excessive stress on the work, chuck or holder, and bit. A must in such work is to maintain a keen cutting edge and to keep the feed gradual. For cutting steel, use a tool that is ground to produce an effective shearing action.

Nonround workpieces, such as a rectangular steel block, are generally clamped in independent four-jaw chucks. If necessary, jaws can be reversed to accommodate the work and reduce jaw overhang.

A flat surface (for example, a block to be squared-up when toward the chuck or faceplate) can be leveled by one of three methods: 1. Placed against chuck or faceplate surface with jaws or clamping devices tightened to prevent an edge from moving away from the surface; 2. Rested against jaw steps that are equidistant

from the chuck face; 3. Positioned with the aid of round rods, or rectangular bars of uniform thickness, used as shims. As you tighten the chuck jaws, keep the workpieces in good contact with shims, then tap shims endwise and remove before starting.

When the surface to be machined is reasonably flat, but thickness varies or the opposite surface is not suited for leveling, the block can be positioned with the help of a dial indicator or by the method shown in the bottom photo at right. With the compound slide set at about a 30° angle to the lathe axis, the micrometer scale on the compound screw is used for checking positions of the four corners of the outer surface. The tool bit is run forward until it stops against the workpiece face near one corner and a scale reading is made. Then, the bit is retracted and the workpiece turned to bring the second corner into alignment with the bit for a second scale reading.

Continue adjusting the block until all four corners are within a few thousandths of being in the same plane. Done this way, only a small amount of material need be machined off to produce a true, smooth surface.

Surfacing a block may consist of feeding the tool with the cross-slide screw all the way from the outermost edge, or corner, to the center. There are also jobs in which the area to be machined lies near the outer periphery of the chuck or faceplate. In such cases, the setup must be made so the work is positioned where the bit engages it without striking the chuck jaws or any other part of the workpiece.

To square round stock, as in making a socket-wrench handle, the tool must contact only the end to be squared. If you are machining two of the surfaces, the rod end being squared must be shimmed to compensate for metal removed from the other two surfaces. The rod has to be positioned so opposite surfaces will be parallel, unless you want to provide relief (as for a punch) because the same setup can be used to produce triangular, hexagonal or even nonsymmetrical sections. This setup can also be used for cutting side openings in tubular pieces.

Straight edges can be machined on small pieces clamped in a chuck or faceplate fixture. They must be held firmly and in proper alignment with respect to



MICROMETER SCALE used on compound slide is angled at about 30° to check alignment of block being machined to reduce thickness, true up the surface



MACHINING A FLAT END of $\frac{1}{2}$ -in. steel rod, slightly curved margin is usually not objectionable. Below, workholder is used when planing small work





JIG FOR MACHINING ROD ENDS is of scrap cast iron. Hole drilled to accommodate rod snugly is fitted with two brass setscrews to hold the work securely

amount of tool travel and the edge bevel.

The photo at the bottom of page 195 shows a setup improvised from a small angle bracket (salvaged from a junkbox) and a faceplate having a dogtail slot. The bracket happened to have a clamping arrangement that operated somewhat like vise jaws under the squeeze of two bolts. It also was not quite square—less than 90° —and required shimming.

Cutting the ends of short rods or tubes



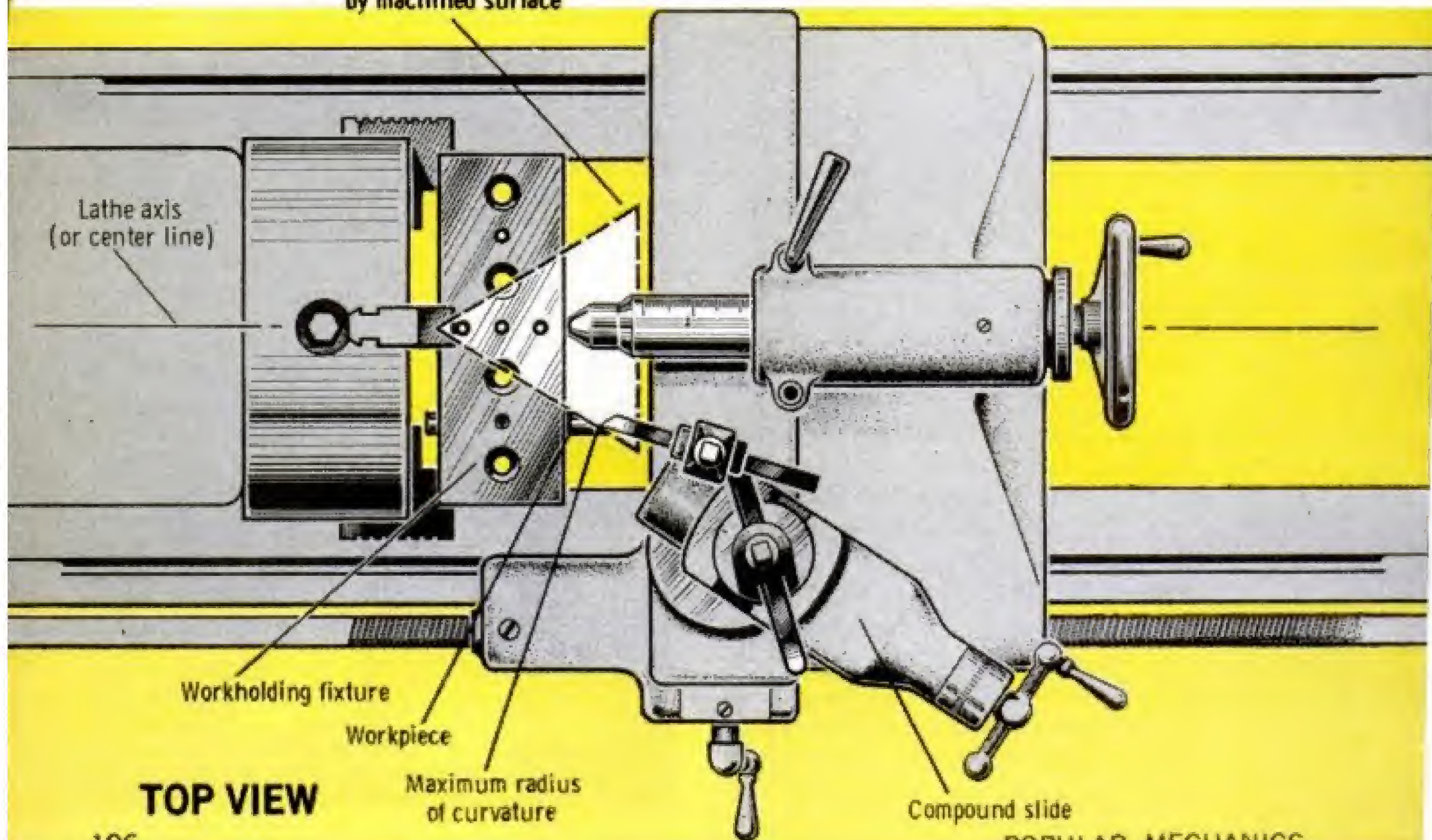
TO SHAPE END OF ROD to fit cone of 66° angle (funnel side), compound is set at 33° to lathe axis. Hole for tailstock center must be drilled accurately

to precision angles is easy when the workpiece is mounted securely in a chuck or faceplate fixture so that it projects at the required angle. To make a cut, the lathe tool is moved gradually crosswise with the cross-feed screw.

The fixture shown in the middle photo on page 197 is a scrap bar of steel clamped firmly in the four-jaw chuck. A hole was drilled at the desired angle near one end of the bar and a $\frac{1}{4}$ -20 setscrew installed

TYPICAL SETUP FOR PLANING CONIC SURFACE ON ROD

Imaginary cone segment generated by machined surface



to lock the piece to be machined. This bar also has a similar hole at a right angle to the first hole, for holding a rod whose end is to be machined square—that is, 90° with respect to rod axis. The same setscrew serves both holes.

Using a little imagination, it would not be difficult to make a fixture that could be adjusted for producing a wide range of angles on rod or tube ends. For example, if the workholding bar (see photos at top of facing page) were round instead of rectangular in cross section, it could be rotated to vary the angle. Here the jaw bite would be less at the ends. Normally, the workpiece would be clamped in a hole drilled at a right angle to the bar axis, but you can compound things further by angling the hole outward and rotating the bar to an angular position.

Conical surfaces

For machining a flat surface on the end of a rod or other piece, the cutting tool is moved straight across the lathe bed by means of the cross-feed screw. But, if you set the compound slide at an angle and use it to control feed, the resulting surface is a segment of a conical surface.

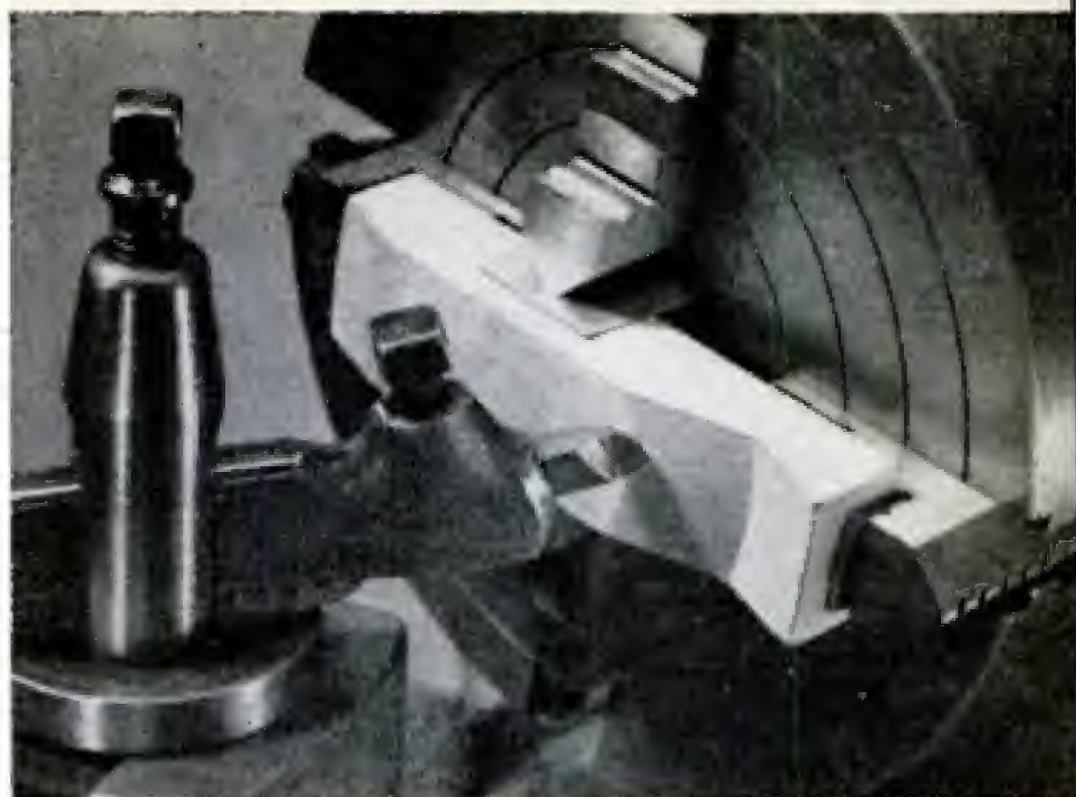
The piece of maple wood shown in the chuck (top, right) is a good example of conical planing. The V-notch has been cut near one end by compound-slide movement. The outermost concave surface of the V was formed with the tool right-side up and operating at the front of the lathe. The convex, or second half, of the V was cut with the tool inverted and operating at the back of the lathe. (You'll notice that some of the other end of the piece is cut away during the second step.)

Of what use is such a stunt? A number of V-cut blocks could be glued together, side by side, to produce a novel molding or panel. If you want an even more pronounced surface curvature, simply cut the notch nearer to the chuck center.

The ability to produce conical surfaces by controlling tool movement with the compound slide on a workpiece located offcenter in relation to lathe axis, can be put to use to shape a rod end to make a special chisel or gouge.

To produce the novelty nut or candy dish shown in the lead photo, three metal rods were machined so that their ends fit neatly against the outside of a tin-plated funnel. You may never need a funnel

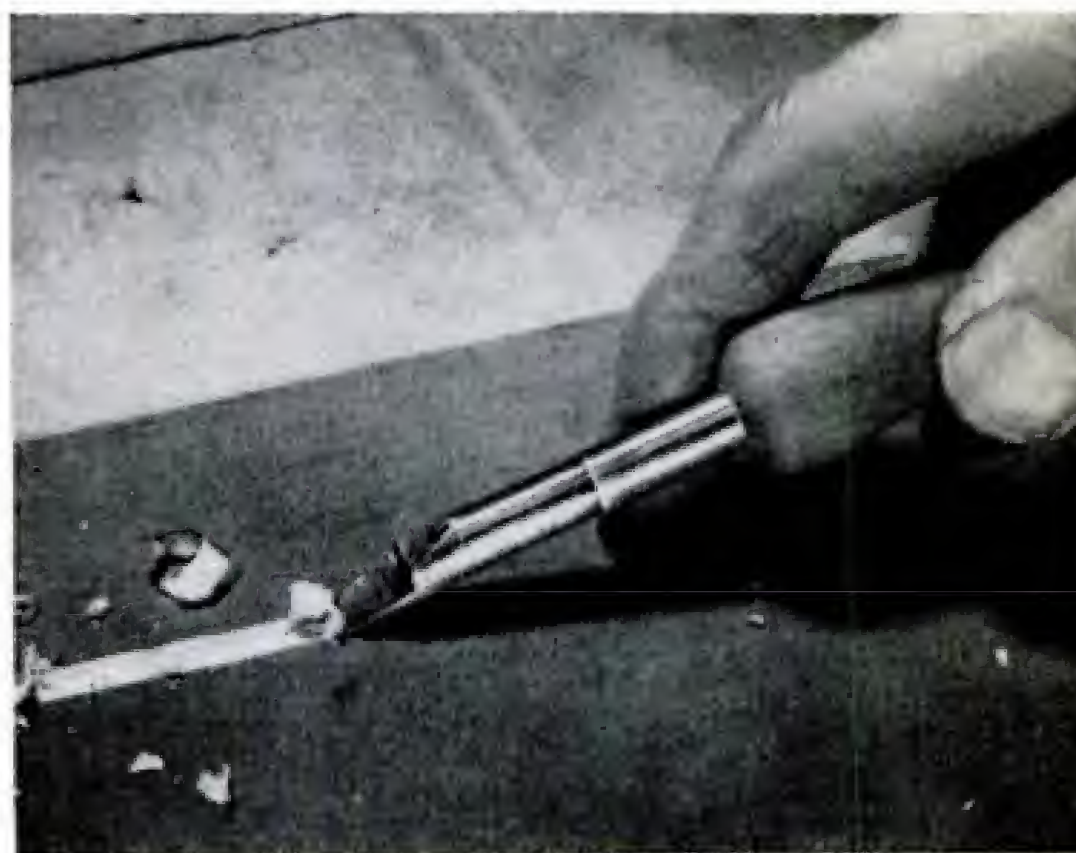
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COMPOUND SLIDE can be used to produce concave or convex surfaces depending on the position. Block of maple is shown mounted in the back position



MOUNTED AT AN ANGLE to chuck or faceplate, end of rod is machined flat and diagonal. Here, end slope depends on angle of hole drilled in holding block



CUTTING EDGE OF GOUGE was formed with compound slide set at about 15° angle to lathe axis. Radius of swing was approximately $\frac{5}{8}$ -in. minimum

DENT PULLER FROM PIPE PARTS

Here's how it works: You first solder a flathead nail or screw to the center of the dented area to serve as a stud. Then you place the puller over the stud and tighten it with a setscrew. To pull out the dent you simply turn the nut on the end of the bolt. When the dent's gone, you unsolder the stud.

Besides pulling dents, the puller will be handy for extracting pins, small gears and wheel hubs.

A soldered nail or screw will usually do the trick when the dent is in light metal. However, on heavier metal you may find it necessary to braze the stud to keep it from pulling free since the tool exerts considerable pull.

I used a 1-in. pipe cap for the base of the puller and bored out the threads, although you really don't have to do this. Then I drilled and tapped the cap for a $\frac{3}{8}$ -in. pipe nipple $3\frac{1}{4}$ in. long. "Windows" are required in opposite sides of the cap to reach the setscrew that locks the puller to the stud. To cut the oval-shape windows, I first drilled two small holes and reamed them to $\frac{5}{8}$ in. Then I cut away the metal web between the holes and filed the sharp edges smooth with a rattail file.

To cut the narrow slot in the side of the nipple, I drilled a row of overlapping holes for a distance of $1\frac{1}{8}$ in. to accept a 6/32 machine screw and then filed out the slot with a small rattail file. The slot is located $\frac{3}{8}$ in. from the pipe threads.

Next I drilled a No. 27 hole $1\frac{1}{4}$ -in. deep into the end of the hex bolt. Then I drilled a second hole at right angles ($1\frac{1}{2}$ in. from the bolthead) and tapped it for the 6/32 stud-locking screw.

When the pipe-cap rim is too far from the dent, and pulling tends to form an outward bulge, a large washer, or other metal plate with a hole of suitable size in it, can be interposed to concentrate the force in the dent area.

For pulling hubs and pins, the bolt head can be modified as required—perhaps fitted with a chuck that will grip less roughly than a setscrew. ★★★

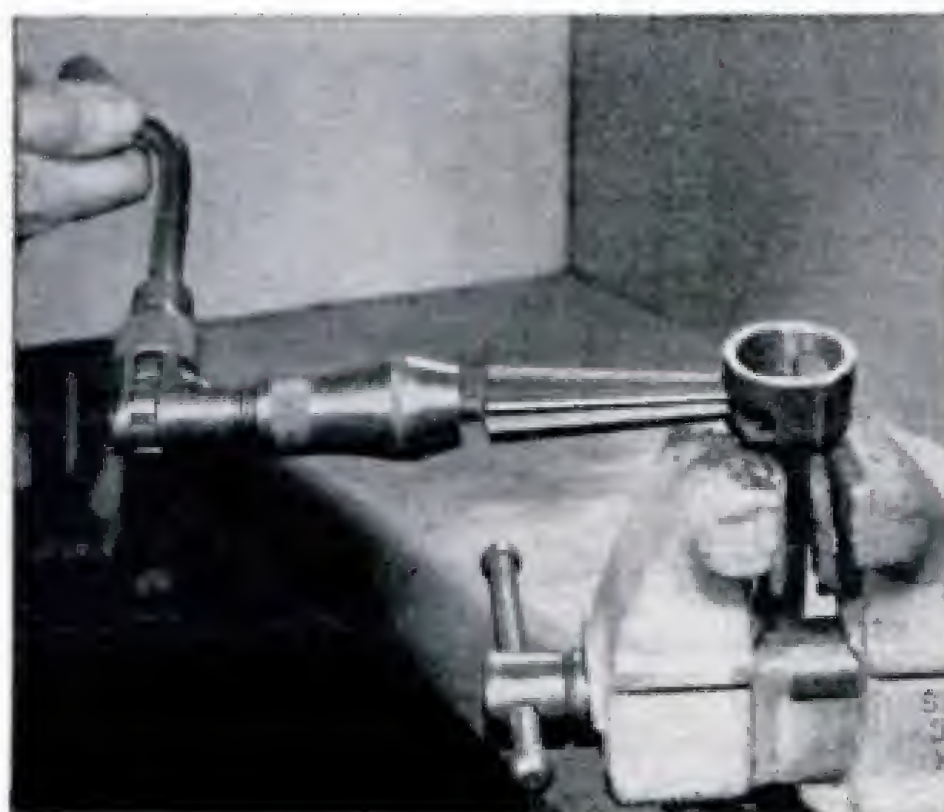
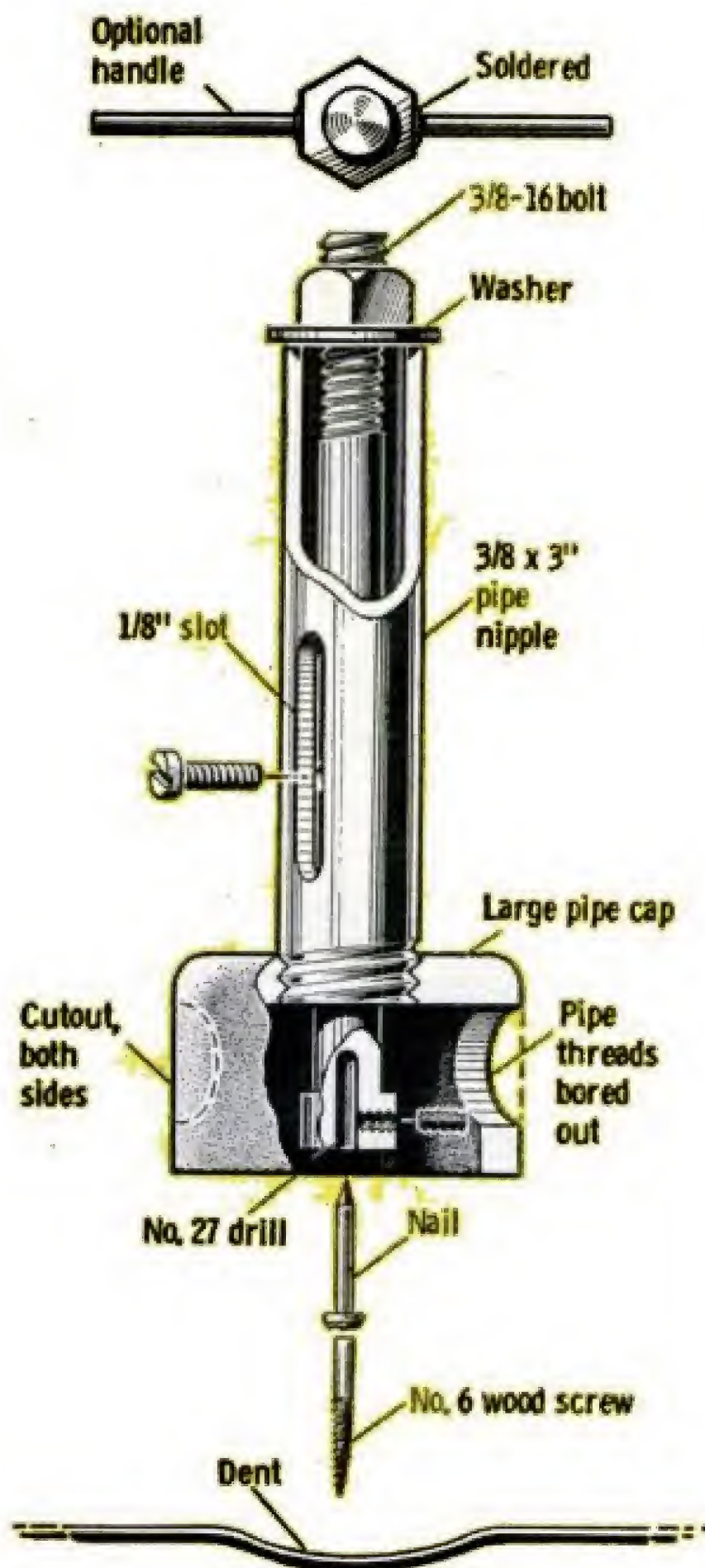
POPULAR MECHANICS

By WALTER E. BURTON

NINE TIMES OUT OF TEN you can hammer out a dent in metal from the back, but there's always that one time when you can't. Such is the case when you bash in the side of a metal container, the pump on a garden sprayer or other sealed receptacle. When this happens, the job requires a puller, such as this one made primarily of pipe fittings and a hex-head bolt.



NAIL STUD soldered to dent is "handle" for puller. Flat end of puller works on round surface; saddle from a bent washer placed over the stud is better



"WINDOWS" IN PIPE CAP are formed on each side by enlarging pair of holes with reamer, then cutting away remaining web. File is used for final shaping

OCTOBER 1969

HINTS FROM READERS



Rasp shaves turning quickly

On occasion I use my metal lathe as a wood lathe and, when the turning might be a simple cylindrical shape, I have found that a rasp, such as a Surform or a Versaplane, provides a fast-cutting "chisel" for roughing-down the work. With no regular toolrest to support the tool, I hold the rasp like a file in conventional lathe filing, being careful to keep dangling shirt sleeves out of the work. When the turning is brought down to rough size, I switch to a coarse-tooth file, then finish with sandpaper. It's a good idea to cover the ways of the lathe to catch the chips and dust.

—Walter E. Burton

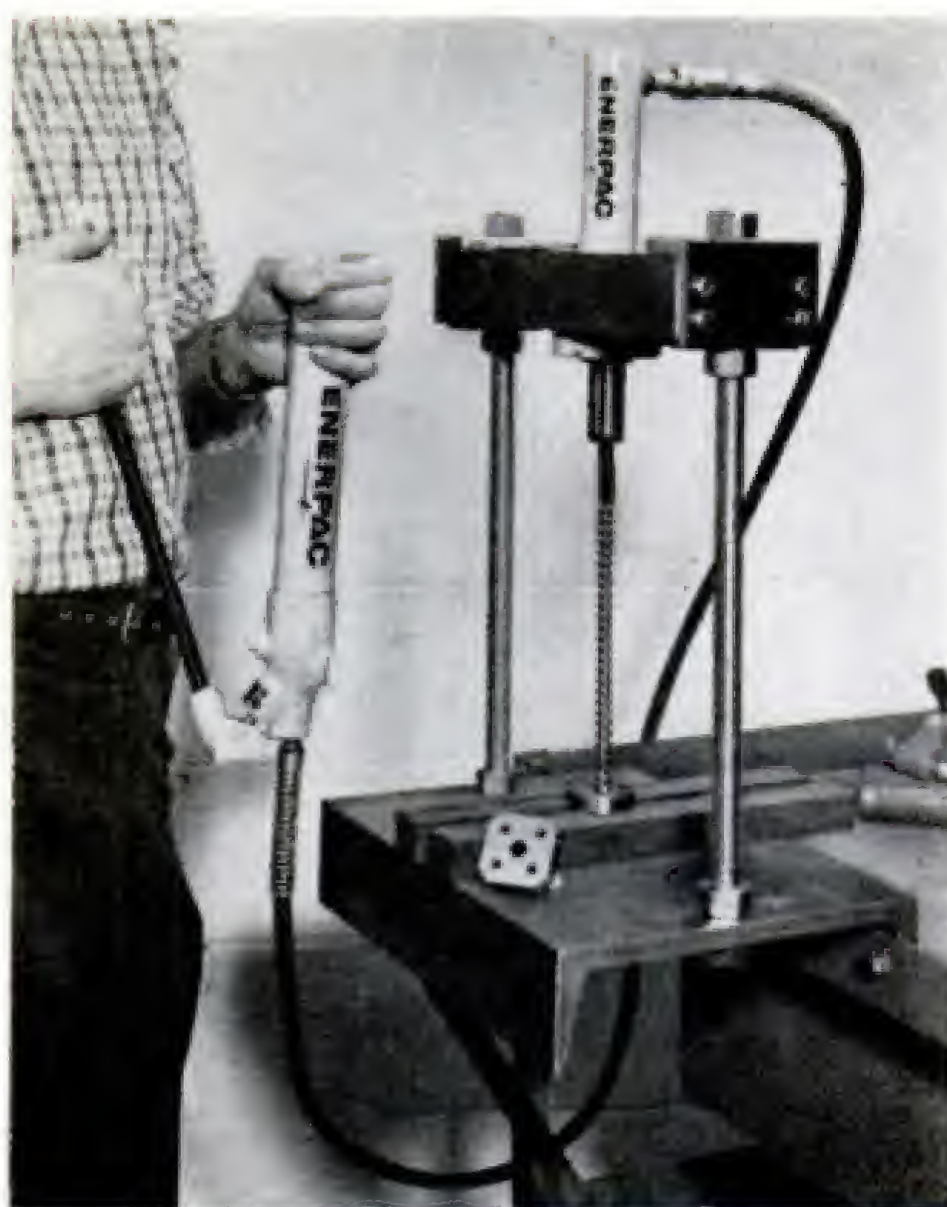
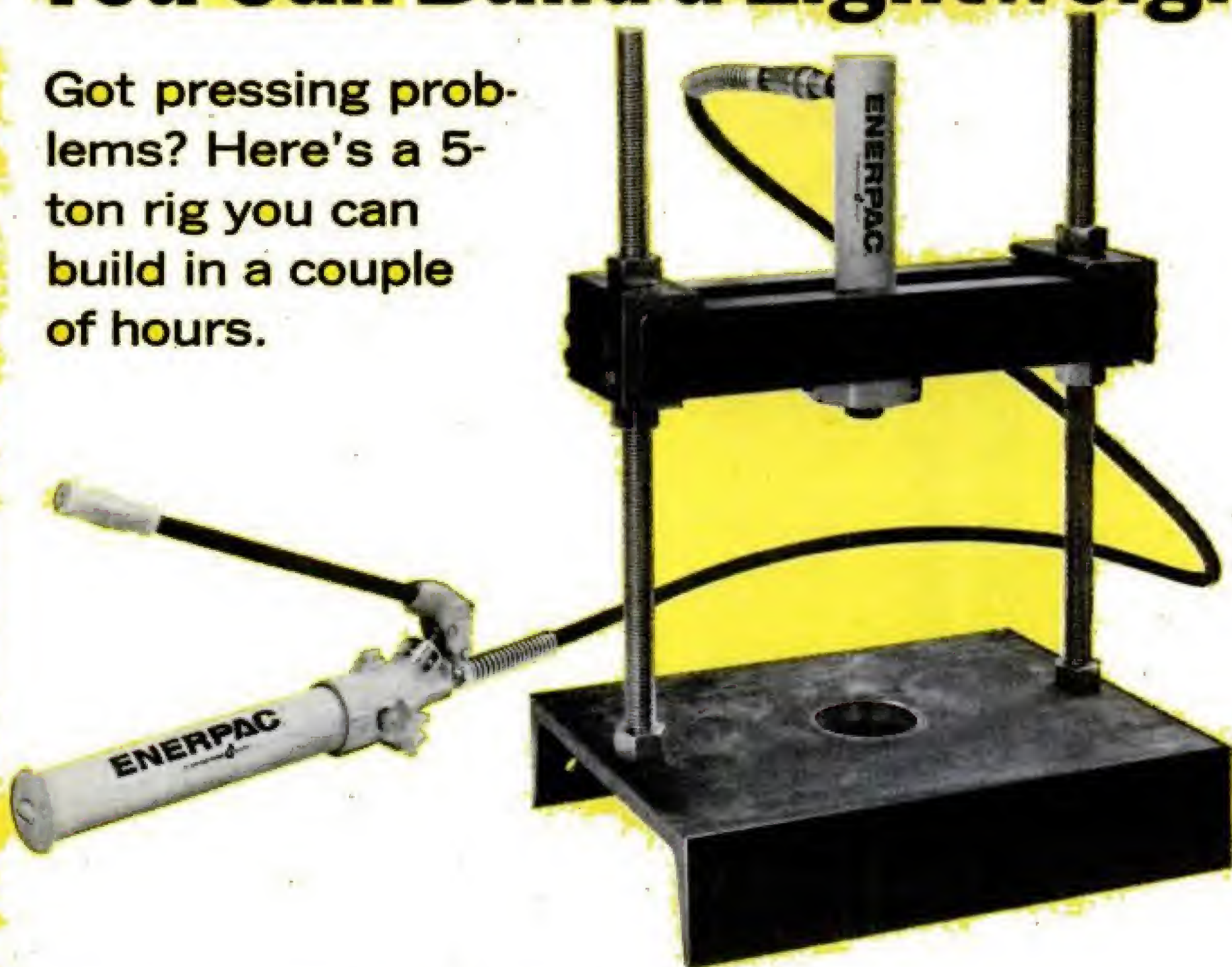


Glass cutter serves as wrench

You might not think of your glass cutter as a wrench, but it will serve in a pinch when you are faced with tightening a tiny nut. Just pick the notch that fits the nut and use the cutter like a regular open-end wrench. It won't mark up the nut like pliers do.—Ken Murray

You Can Build a Lightweight

Got pressing problems? Here's a 5-ton rig you can build in a couple of hours.



TO CUT HEX HOLE, opening is adjusted to fit broach. Press forces the tool through part being worked

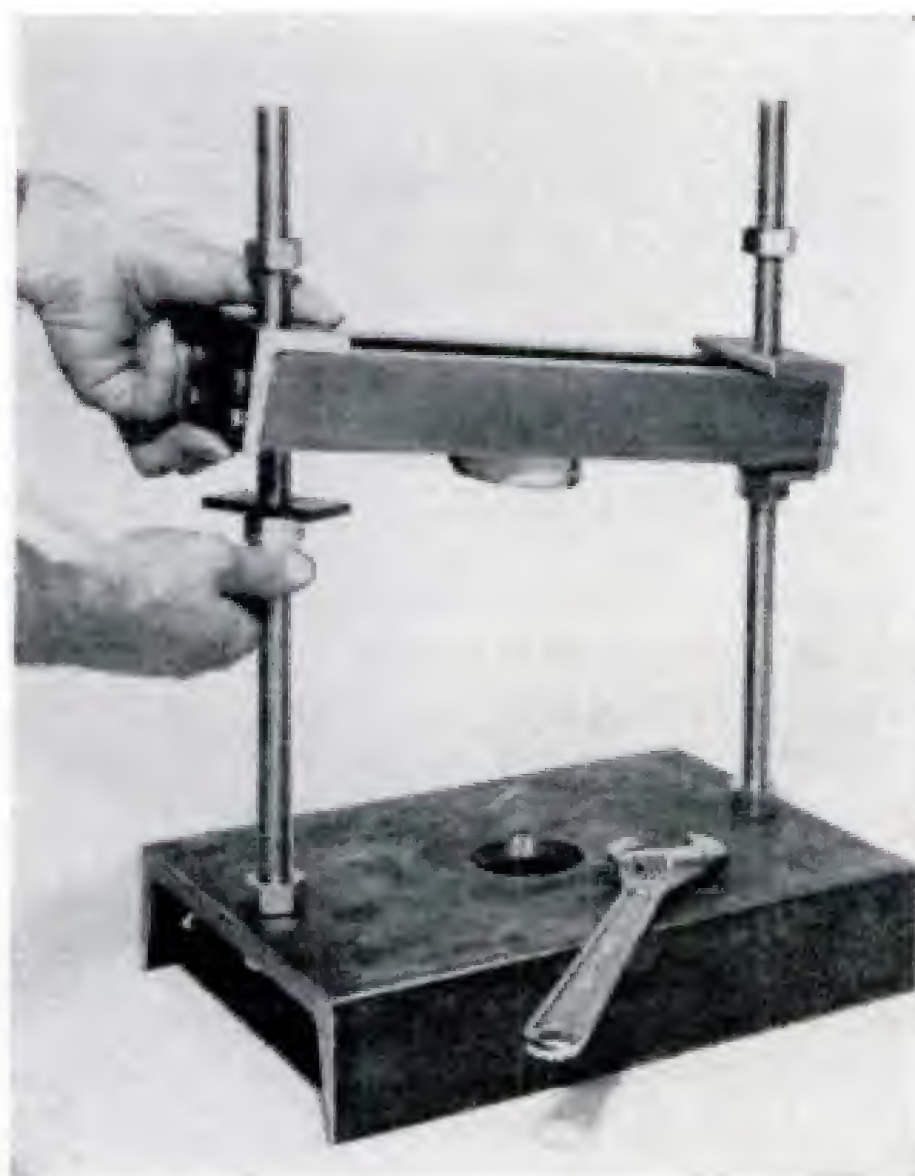
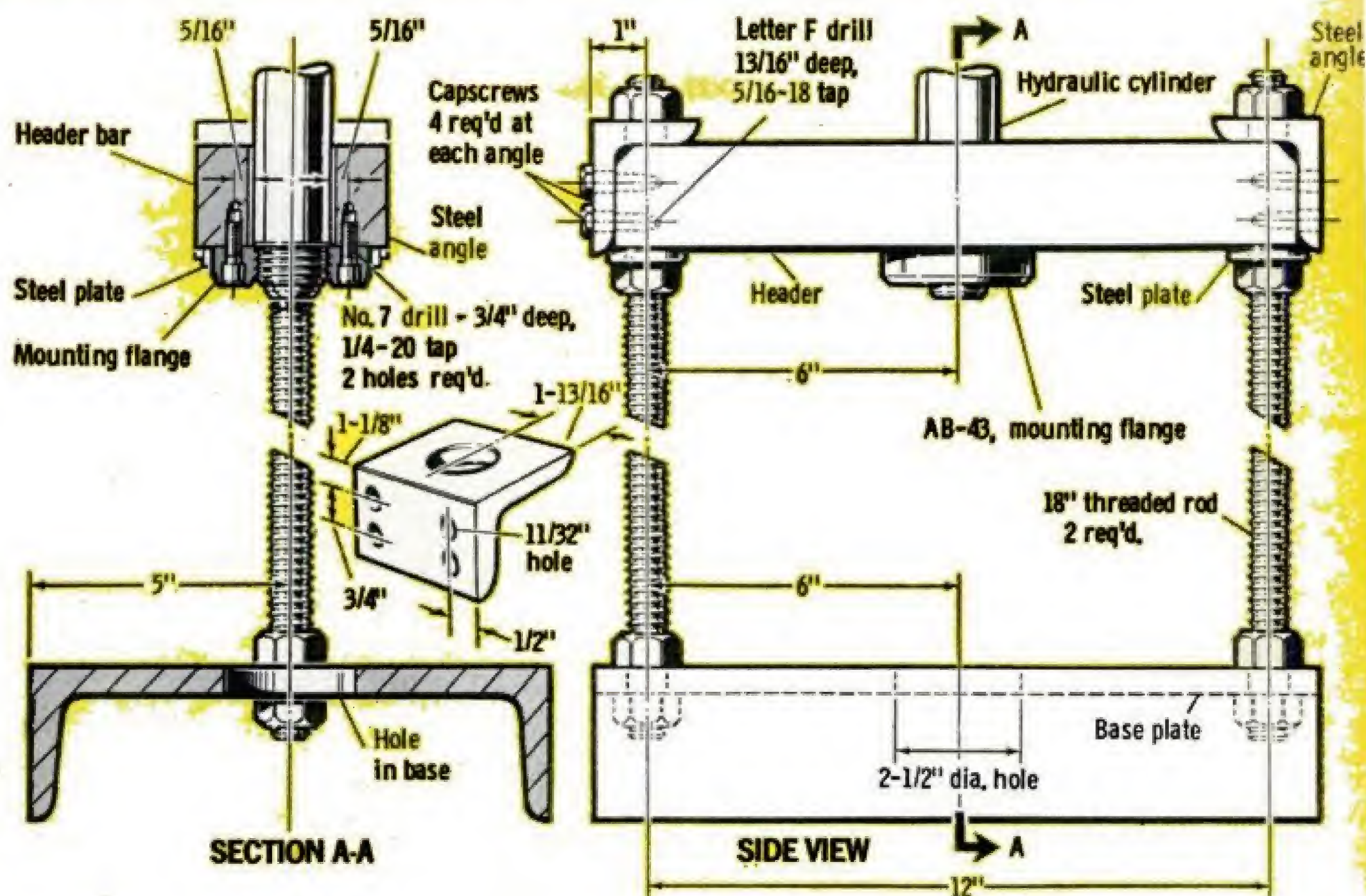
FULLY ADJUSTABLE, this press can be built quickly to handle home or professional workshop pressing problems such as bending, aligning, laminating, deep-drawing, and more. Though surprisingly light in weight when assembled, about 50 lbs., it gives full versatility of use with up to five tons of force.

The muscle of the unit is the Enerpac S-150 hydraulic set. Priced at \$89 including the mounting flange, the tool delivers the flexibility and ease of handling usually found in more expensive presses. The steel components which complete the set-up, can be bought locally and will up your cash outlay another \$15.

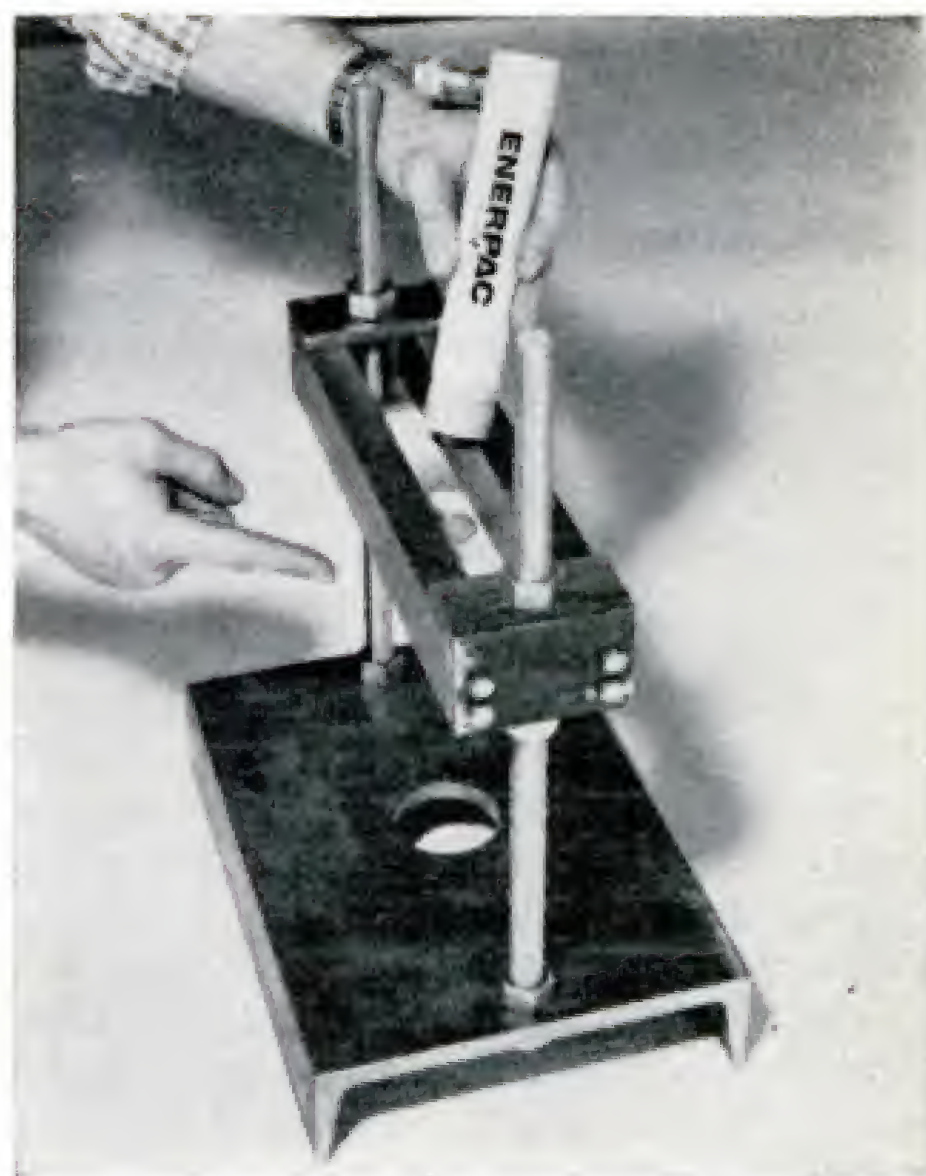
Built-in versatility

Since the steel press header can be adjusted up or down on the threaded rods, the press can be quickly adapted to suit the size and shape of the workpiece to be pressed. The opening (daylight) can be altered to suit the job at hand. (Daylight

Press for Heavyweight Jobs



THREADED ROD determines maximum opening. If large opening requirements are expected, use longer lengths



MOUNTING FLANGE bolted to header, receives the threaded end of cylinder, securely holds it in place



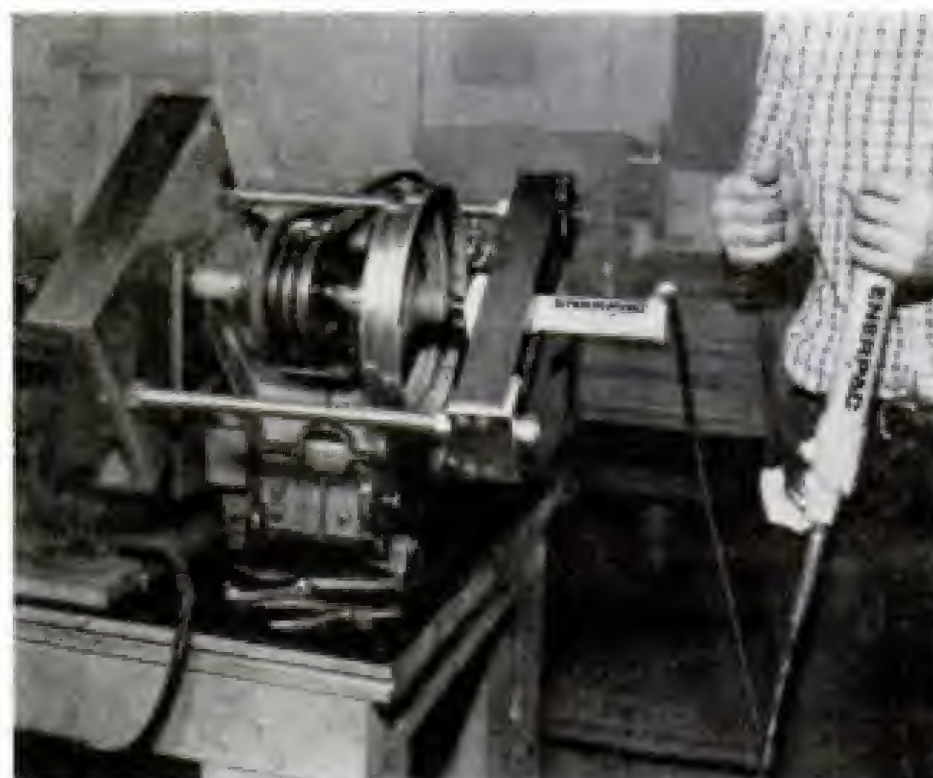
PRESSING AXLE BEARING is easy and fast. Hydraulic-control characteristics insure smooth pressing job



NEW BEARING being pressed in, pushes out old bearing through hole in base plate in the same operation



SMOOTH 90° BEND is made with reduced opening. Clamped steel acts as female die, bar serves as male



USED HORIZONTALLY and adjusted to its full opening, press handles unwieldy part such as lathe pulley

opening is measured from the press base plate to the plunger end cap of the hydraulic cylinder.)

For example, equipped with 18-in. rods the press shown is adjustable from a 12½-in. maximum, down to a ⅝-in. minimum opening. Horizontal daylight is 10¾ in. Thus, by having on hand several pairs of rods of varying lengths, you will have a wide selection of daylight openings.

Another good feature is the 2½-in. hole in the base plate which lets you put extra-long pieces through the base if necessary. The hole can also be used for push-through operations or, when not wanted, covered with a steel plate.

But you are not limited to the shape or size shown. The hole can be made smaller, or its shape changed, when you are fabricating the press or to suit a particular job.

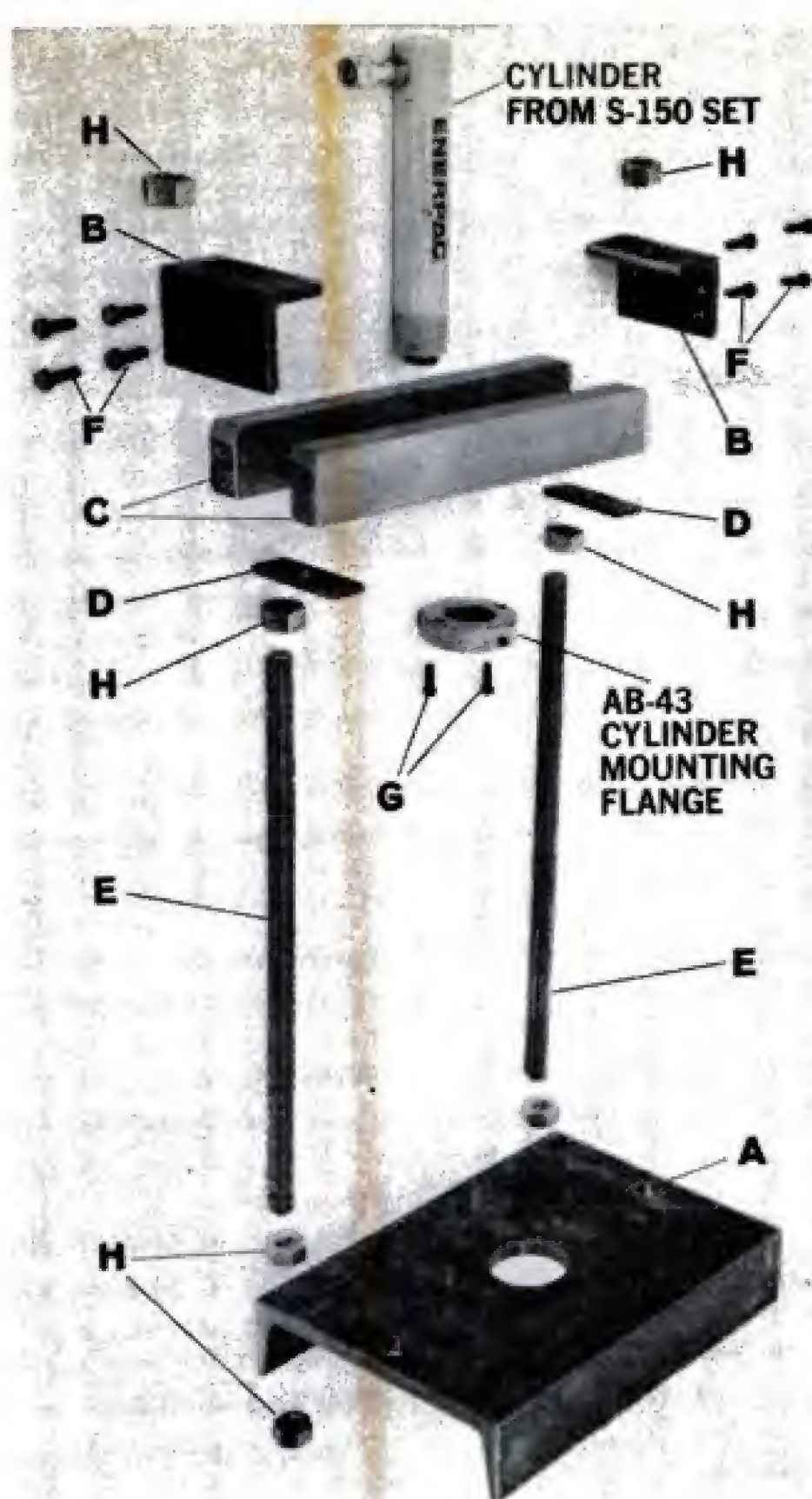
The five-ton hydraulic cylinder (similar to a jack) has an 0 to 5¼-in. stroke,

or plunger travel. This gives the operator the choice of using the full travel or adjusting the header down close to the work to use only a fraction of the cylinder stroke to contact and press. The latter technique is recommended for operations where speed is important.

There may be times—awkward-shaped workpiece for example—when this method of operation is undesirable. Here, because of the long cylinder stroke, you can be away from the work, but still reach it for your pressing cycle.

The hydraulic cylinder

Of spring-return design, the cylinder pulls back the plunger to a completely retracted position when the load-release valve on the pump is opened. This releases the press load on the part being worked and retracts the plunger out of the way. The action is good and makes



STEEL PRESS COMPONENTS drilled and ready to assemble (above). Materials list identifies the parts

for fast, easy removal and insertion of parts to be worked.

The basic Enerpac unit consists of a hydraulic hand pump, high-pressure flexible hydraulic hose and the five-ton hydraulic-spring-return cylinder. It operates simply by turning the load-release valve clockwise and actuating the pump handle. The pump transmits hydraulic oil from the pump reservoir into the cylinder. The cylinder then converts pressure applied by the pump into forces several hundred times greater than the force at the pump. To release the press load on the part being worked, the load-release valve is turned counterclockwise, permitting the oil to drain back to the cylinder-pump reservoir.

Built-in bonus

Being light in weight (12 lbs.), the S-150 can be removed quickly from the press and toted to work that cannot be moved. Thus, you can use it for on-the-spot force applications such as prying, bending, jacking or pushing.

For buying information about the Enerpac hydraulic unit, write to Enerpac Div., Applied Power Ind. Inc., Dept. 901, Butler, Wis., 53007. The steel component parts for the frame are available at local steel warehouses. Make certain the steel you buy meets the specifications given for full five-ton-capacity strength.

—Harry Wicks, Workshop Editor

MATERIALS LIST				
Key	Pieces	Description	Length	Size & Specifications
A	1	Steel channel (for press base plate)	14"	10" x 25 lb./ft.
B	2	Steel angles (for header ends)	3 1/4"	2 x 2 1/2 x 3/8"
C	2	Steel bars (for headers)	13 1/4"	1 x 2" (cold finish)
D	2	Steel plates (for header supports)	3"	1/4 x 1 1/4" (cold finish)
E	2	Threaded steel support rods (posts on press)	18" (optional)	3/4-10nc
F	8	Hex head capscrews (for header angles)	1"	3/8-18nc
G	2	Socket head capscrews (for mounting AB-43 flange)	3/4"	1/4-20nc
H	8	Hex nuts (for header, base & rod assembly)	—	3/4-10nc
—	1	Enerpac S-150 set (pump, hose and cylinder)	—	5-ton capacity
—	1	Enerpac AB-43 cylinder flange (for mounting cylinder to press)	—	—

ANNOUNCING: The Handiest Tool in Your Shop!



WE KNOW YOU'LL AGREE when you see the *Popular Mechanics Master Shop Guide*. We've printed all the aspects of shop know-how and home maintenance on 12 heavy plastic-coated cards that you can hang right above your bench. Here's everything you need to know about choosing and using nails, screws, bolts, wall fasteners, drills and abrasives. Here are all the basic facts on lumber, plywood, hardboard, glues, adhesives, hardwoods and wood finishes. The most-used plumbing and electrical fittings are illustrated, with tips on where and how to use them. Want to know how many floor tile or wall tile you'll need, or how many rolls of wallpaper? Easy-to-read charts show you at a glance. Remodeling? All the recommended measurements for doors, windows, kitchen cabinets, closets, even furniture of various types, are listed. You'll find complete information on the right chemical to use to knock out specific lawn and garden weeds and diseases; gutter and downspout repairs; many other subjects. The first card alone, in addition to an exact-size nail guide, includes a ruler, centimeter rule, protractor, 45° triangle, and a big compass that permits you to draw precise circles up to 19½ in. in diameter! Fifty-six charts and scores of drawings give you the essence of all how-to information, right at your fingertips. No shop is complete without the *Master Shop Guide*.

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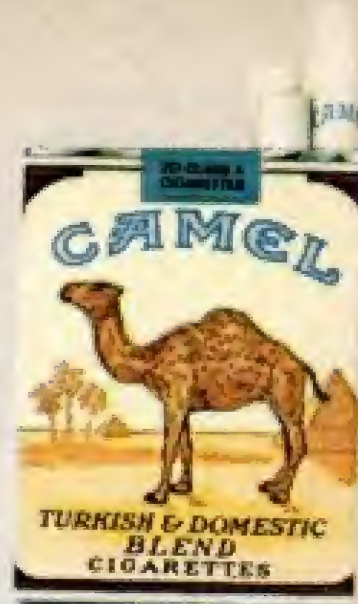
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POPULAR MECHANICS

"I'd walk a mile for a Camel."

This message is strictly for smokers who never tasted a Camel cigarette.
Camel smokers, you know what we mean. You other guys, start walking.



MECHANICS OF MEDICINE

(Continued from page 141)

meter which sounds an alarm or flashes a light if the rate becomes too fast or slow, or with each premature or delayed beat.

An orange-colored screen is used because it's said to be highly visible in a well-lighted room. Honeywell's new system incorporates a photoelectric cell in the front of the unit: this automatically varies the intensity of the oscilloscope in relation to the light in the room to maintain best visibility. The oscilloscope is actually a cathode-ray tube identical with your TV picture tube.

The nurses' seeming disregard for the screens arises from the fact that it's easy to hear a change in the rhythm of the beeps. The experienced nurse can even pick out one particular patient's beeps from the seven or eight, or more, sounding away—and respond immediately to the slightest variation.

... some can speak with an electronic larynx only two days after a laryngectomy.

In the United States some 3000 successful laryngectomies (operations for removal of the larynx or voice box) are performed every year, virtually all due to cancer of this organ (9 or 10 men to every woman,) but occasionally to war injuries and hunting or auto accidents. A year ago, there were some 25,000 laryngectomees—those who've undergone laryngectomies—in America. The operation seals off the lungs from the throat and mouth, making ordinary speech impossible. The person breathes through a small hole, "stoma," created in the base of the neck. Dr. Hayes Martin, one of the world's great surgeons in this field, points out that today's doctor can confidently assure his patient of reasonably adequate speech following this surgery. Two methods are available—"esophageal speech" in which the individual swallows air and, with what amounts to a controlled belch, uses it for speech, and the electronic larynx.

Dr. Martin tells how Gilbert Wright, son of the author-minister, Harold Bell Wright, noticed that he could convert the buzzing sound of his electric razor, as he held it against his neck, into speech. Wright developed a battery-powered buzzing device, the Sonovox, which was originally used in motion-picture cartoons for producing human voice effects from nonhuman objects. In 1942, Wright

utilized it to produce the first workable electronic larynx.

Success of the electronic larynx lies in the fact that it can be used as you speak. If somehow you were able to listen, during speech, to the air as it leaves your vocal cords you would hear only a buzzing sound. Words and sounds of speech are produced by changes in the shape of the resonant cavities that make up your vocal tract—throat, mouth and nose. Speech is made possible not by the flow of air from your lungs but by its vibration—the vocal cords are there to set the air vibrating. Pressed against the neck, vibrations of the electronic larynx are transmitted through the soft tissues to make the air in throat and mouth vibrate. Then, using mouth, throat, tongue, lips and teeth as in normal speech, the laryngectomee can speak once more.

So natural is this process, that some can speak with an electronic larynx only two days after a laryngectomy. Esophageal speech, however, usually takes months to learn and there is doubt as to how many can learn it successfully. For those who cannot, the electronic larynx has made recommunication with the world possible. It has also made immediate speech possible following surgery—until esophageal speech can be learned.

The Bell System's electronic larynx is deceptively simple, with little that can go wrong. Designed by Bell Telephone Labs and produced by Western Electric, it is distributed by local Bell companies and sold on a nonprofit basis. About six inches long, beige in color, and tapered with its head offset at a 70° angle, it could almost be taken for a electric razor.

The device comes high-pitched for women and low for men. Fingertip control allows variation of pitch to produce more natural inflection and emphasis. It is said to provide a 97 percent sentence intelligibility, even allow some to sing simple tunes. Its speech volume is about that at normal conversational level. The principle is that of a small vibrating driver or transducer (actually a modified telephone receiver.) On the head is a button the size of a 50-cent piece and 1/4 inch thick. This is cemented to a diaphragm like that in your telephone receiver but producing much stronger vibrations, for little power is needed to move your eardrum.

The artificial larynx utilizes two commercial mercury batteries and a pair of power transistors. In normal conversational use the batteries can last weeks, even months. While sound leakage produces a background buzz during use, some experienced users have learned to eliminate it during their speech. ★★

What makes a snowmobile great?

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Say it in one word. Performance. A get-up-and-go snowmobile that turns any stretch of snow into an open highway. One word, but a dozen design refinements in the '70 Polaris make it happen. Like powerful twin-cylinder Star engines, new Drift-Skipper suspension, Polaratone muffler, and dependable electric start. These are just a few of the pace-setting innovations in the 1970 Polaris. Take a test drive. You won't risk anything but temptation. Polaris Industries, Roseau, Minnesota. A Textron Division.

TAME A POLARIS ON THE PONDEROSA

Win a trip for two to the Ponderosa Ranch of "Bonanza" TV fame. Register at your Polaris dealer.

BACK TO EARPHONES YET!

(Continued from page 150)

chestra. Watch for the presence of bass, even in soft passages. The low notes shouldn't drop out.

Listen for crispness in the sound of such instruments as harpsichord, guitar and percussion. Nobody wants to hear a soggy drum. And watch for the telltale mark of inferior design: high-frequency distortion. Violins, for example, should sound silky and smooth—not like chalk scraping on a blackboard.

As with loudspeakers, frequency response figures listed in the catalogs are not always meaningful. Some manufacturers claim an upper response of 30,000 cycles and a lower limit of 10 cycles—a range far greater than that of any high-quality loudspeaker system. The fact is, it isn't really too important whether the range goes above 17,000 cycles because beyond that point sounds become too high for the human ear to hear anyway.

As for the low end, few earphones put out much effective bass below 50 cycles, no matter what the specs say. Few speakers do much good in that range either. The best way to check the bass performance of any model is to listen to a test record with test tones in the 30 to 50-cycle range.

What really counts, though, is not the ability to reach extreme highs and lows, but the balance and clarity of the sound spectrum from about 50 to 12,000 cycles. The best test for this is listening to a good, clear recording of a full symphonic score.

Aside from sound quality, comfort is the main factor in picking your earphones. You should be able to wear your headset as easily as a comfortable hat. Weight, of course, is important, and such designs as the AKG-Norelco, Sennheiser and Telex Encore are outstanding for lightness.

More important than weight, however, is proper fit. Even the heavier models don't become burdensome if they fit comfortably on head and ears. The headband is rarely a problem because it's either flexible or adjustable. Earpieces, however, have fixed dimensions, so make sure they don't squeeze or pinch your ears. They should fit around the ears, not ride on top of them. Otherwise, you don't get a tight air seal and lose bass response. Some ear cushions are liquid-filled so that they mold themselves to the contour of your head. Others rely on foam material for a firm sound seal.

Some models have separate volume and/or tone controls right on the headset. While they are not a necessity, some listeners may find it convenient to be able to make loudness and tone adjustments

without having to get up and fiddle with the controls on the amplifier.

Connecting up your earphones is a simple job, but the procedure may vary slightly depending on the type of headset you buy and the kind of arrangement you want. Headphones come in a variety of impedance ratings, all the way from 8 ohms up to 50,000 or more. Impedance is a measure of electrical resistance. Ideally, the impedance of your headphones should match the impedance of your amplifier's output, although this is not a must in all cases. You can connect high-impedance phones to a low-impedance source with no trouble. Do not, however, attempt the reverse. Connecting low-impedance phones to a high-impedance source will result in loss of volume and distortion.

Modern amplifiers and receivers usually have front-panel stereo phone jacks that make it easy to plug in a headset without doing any wiring. In most cases, these jacks represent a low impedance and thus will accept either low or high-impedance phones. Follow the directions supplied with your particular headset for any special wiring instructions. Should you find you have a serious impedance mismatch between your headphones and your amplifier's output, it's possible to get a small matching transformer that will solve the problem. Some earphone makers, like Superex, can provide matching transformers in a variety of impedances to suit any situation.

Chairside control desirable

One handy headphone accessory is a remote chairside control. Available in a variety of makes and models, this is basically a small box connected to your set by a 15 or 20-foot multi-conductor cable. It provides two earphone jacks and controls for adjusting balance and volume without getting out of your chair. There's also a switch for selecting speakers or phones.

Chairside controls not only offer the convenience of remote switching, but they also make it easy to connect headphones to a set that does not have a front-panel jack. They attach to the speaker terminals at the rear of the set and contain the necessary built-in electronics to provide a proper impedance match. Prices range from under \$10 to \$20 or \$30 for fancier models. For the kit-builder, Heathkit has a model that sells unassembled for \$7.95.

The sudden popularity of earphones may have something to do with the tensions of modern life. In a world full of noise, turmoil and distraction, they provide an island of private, personalized enjoyment. As one grateful music fan puts it, "They're my instant escape hatch."★ ★ ★

Dodge



For the Smart Swinger... the Dart Swinger.

If you're a swinger who thinks your budget can't swing a new car this year . . . take a look at the new Dart Swinger. Our lowest priced two-door hardtop. Swinger's big and roomy inside for that big-car ride. With all-vinyl seats that carry six of the gang around in style. And new, larger standard engines. A mini-fuel 198-cu.-in. Six and a maxi-power 318-cu.-in. V8. Dart Swinger. One low-priced compact that doesn't slight you on looks, comfort, or extras. See Dart Swinger soon.



If you won't
take small
for an answer . . .

you could be
**DODGE
MATERIAL.**



ZOOM TO BIGGER PICTURES

(Continued from page 163)

those that adjust the focus, usually the front set.

In a zoom, there is an additional set of movable lens elements positioned between the front and rear sets. The fixed elements provide what is known as the "prime" or basic focal length, usually about midway in the zoom range. In an 85 to 205-mm zoom, for instance, the prime focal length is generally 135 mm. Shifting the movable zoom elements backward or forward has the effect of increasing or decreasing this basic focal length. As the focal length changes, the image on the film grows or shrinks accordingly.

To keep the image in focus, there is still another movable lens called the "focus compensator." This shifts back and forth along with the zoom elements but at a different rate, automatically keeping the image in focus as it changes in size.

Because zoom lenses are complicated, they are admittedly not perfect in all respects. They may not be as sharp at every focal length as a fixed telephoto lens designed for a single focal length. Usually, there are three or four points along the scale where the image is sharpest, with somewhat less crispness in between. You can find these points by shooting the same subject at different focal lengths on a test roll of film. While differences in sharpness are generally slight, knowing your best focal lengths can be helpful on critical shots.

While zoom lenses are designed to stay in focus throughout their range, it's a good idea to keep rechecking your image to be sure it's as sharp as possible. In some cases, it may be necessary to "touch up" the focus after you've zoomed.

Shoot fast, hold steady

For most of your shooting, other factors will affect the quality of your image more than lens sharpness. Camera motion, for example. If you zoom much beyond 200 mm, you'd better use a tripod, or camera shake, due to mirror bounce or your own unsteadiness, will be agonizingly evident. The reason is simply that magnifying the image has the effect of also magnifying the slightest bit of motion until it becomes a streaky blur. To avoid this, use as high a shutter speed as possible and hold the camera very steady.

Closing the lens opening down several stops, say from $f/4$ to $f/8$, will usually increase not only the actual sharpness of the lens but also its *apparent* sharpness because of the increase in depth of field—more of your picture will be in focus

than with a shallow depth of field. One advantage of higher-priced zooms is that they tend to be "faster"—they require less light than slower lenses. This means you can shoot at a higher shutter speed and smaller lens opening.

Zoom speeds range all the way from an extremely fast $f/2.8$ to a slow $f/9.5$. In the past, slow lenses were a disadvantage because they forced you to shoot at a large lens opening and slow shutter speed, compounding the problems of camera shake and shallow depth of field. Modern fast films give you so much speed, however, that they generally let you shoot at both a small lens opening and a good shutter speed even with a slow lens. This is one reason why today's moderate-priced, moderate-speed zoom lenses can be such a good buy.

Medium-range zoom is best

What type of zoom you select depends on the kind of shooting you want to do. You'll note from the accompanying chart that zoom lenses provide different ranges of focal lengths. Some start at a very short length, almost a wide angle, and go to the equivalent of a moderate telephoto, say 135 mm. Others start at about 70 or 80 mm and go on up to 200 or 250 mm—a fairly long telephoto. Very long zooms start at 200 mm or so and go on up to a whopping 500 or 600 mm. Only a few specialty zooms cover a full range of focal lengths from short to long, and these are very expensive.

A medium-range zoom is the best choice for all-around shooting. Since you probably already have a standard 50 or 55-mm lens on your camera, a zoom that starts at around 70 mm and goes to 200 mm or higher will give you a good range of focal lengths for sporting events, scenic views, photographing boats at a distance, picking faces out of a crowd and similar shots.

Be sure the lens you buy will fit your camera. Some are made only for a particular make of SLR. Most zooms, however, are designed to fit a variety of makes by means of interchangeable adapter rings. Automatic zooms—those that stop down by themselves as you press the shutter release—generally run \$20 to \$50 more than equivalent nonautomatic models and are well worth the extra cost.

One handy accessory you may want to consider is a converter. This is a small supplementary lens that, when combined with a zoom or telephoto lens, doubles its effective range. It doesn't provide the quality of a true telephoto lens, but it's a way of getting a lot of added range at relatively little cost. ★★

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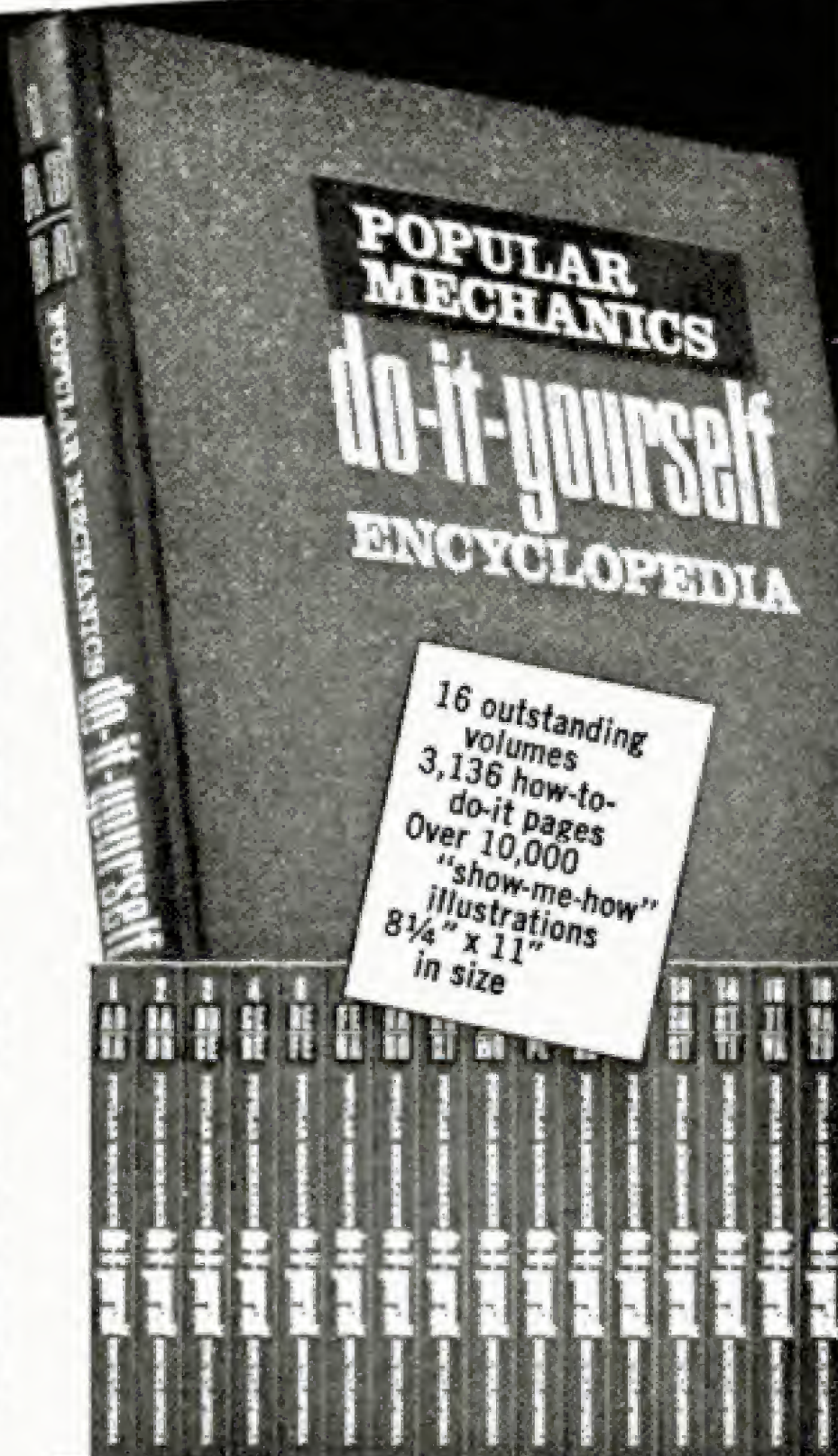
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How to Catch a Hippopotamus

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Build a Christmas Greeting for Your Lawn

Designed especially for *PM* readers, this Christmas greeter is motorized and decorated with Disney characters. Complete plans, including Project-a-Plan slides (which make it a snap to copy the art), are in the November issue.

Oceangoing Drive-In

There's a new type of cargo vessel—the roll on/roll off container ship—that handles almost anything that can be pushed, pulled or driven aboard. The odd-shaped and oversized cargo that won't fit in containers (buses, bulldozers, steamshovels and the like) is rolled aboard over stern ramps while overhead cranes load the container cargo.

Jetting Down Montana's Mighty Missouri

Shallows, rapids and steamboats were all part of *PM*'s test of Glastron's new 17-foot Berkeley jet boat.

Bring Life to Those Forgotten Snapshots: Make a Montage

Mounting a whole collection of prints on a background panel is a handsome way to display photos that usually get stored away in a bureau drawer.

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THE '70 CARS

(Continued from page 106)

around regarding warranties. Some of the hanky-panky brought to light was and is shocking. Yet the industry considers such investigations as being the devil's work, a threat to America's free enterprise system.

To see what sort of reaction I'd get more than anything else, I once said to a high-ranking auto executive, moaning about what he termed "government interference," "The Government is going to save you guys from yourselves." You can imagine how the already ruffled feathers flew. Yet it's true; if the auto industry pursues a narrow, self-serving path, an aroused public is going to flatten it. Cars are no longer a private concern. They are a public one. And the public, however haphazardly, expresses its concern through government. It doesn't take any great insight to see a day—and soon—when a team of government inspectors will be resident in every auto plant. 'Twould be a damn shame, too, because the industry's resilience, imagination and energy would be lost.

In an interview published last February, GM chairman James M. Roche said that by 1980 there would be 115 million cars and 25 million trucks on U.S. roads and highways. If Roche is correct, where in God's name are we going to put them? What are they going to look like? How big will they be? We can't—just *can't*—continue to plunder our countryside and resources just so all of us can have the dubious pleasure of crawling along bumper-to-bumper. A line must be drawn somewhere, and if the industry doesn't draw it soon, the government will.

Discuss this sort of thing with industry officials and they'll say, yes, we're concerned. But on the other hand, the forecast is of ever-spiraling production figures. This, to my mind, is doublethink.

Yet it would be unfair not to point out that this remarkable, uniquely American phenomenon—the auto industry—is coping with, and groping to solve, problems that often seem to defy solution, or at the very least are staggering.

For one thing there's the industry's size. It's so big its channels of communication, both within and without, are clogged. A good idea seemingly takes forever to surface. There are so many cooks working on the broth that individuality, however brilliant, is lost. With this loss comes an unwillingness to experiment and truly innovate.

Keep in mind, too, that unlike, say, the Army, which can operate its sprawling

bureaucracy at a loss, the auto industry must make a profit. Billions and billions, to say nothing of the national economy, are at stake. Obviously, rash actions, genuine deviations from the beaten path have no place in such a prodigious undertaking. The cards *have* to be played close to the vest.

All of which helps to explain why your new 1970 Zipper really isn't very different (or even better) than, say, your 1968 Zipper.

But the rub—again—is that the good gray minds that run the auto industry *know*, for example, that they're putting their "mark of quality" on a certain percentage of defective cars. Does this apparent (and very real) contradiction give anyone pause? Not on your life. Does the fact that last year's fender, called new at the time, is used again this year and is also called new bother any of them? Apparently not.

My plea, then, is for a lot more straight talk out of Detroit. I think the public would respond favorably. We are not so childish that we can't be told the truth. Besides, we're a sporting people, more than willing to give the other fellow a chance. The industry could, I feel, save itself and beat off government predators simply by leveling with us—its customers—and itself.

Is that so hard, gentlemen?

★ ★ ★

THE REALLY NEW ONES

(Continued from page 108)

a fancy SE version. The Challenger offers a number of safety features—reinforced doors, a sort of built-in roll cage for the hardtop, a new energy-absorbing steering column, beefed-up door hinges and locks. Standard engines are a 225-CID Six, a 318-CID 2-bbl. V8. For the R/T, a 383-CID 4-bbl. V8 is standard. Optional on the R/T are Chrysler's muscle engines—the 440-CID and 426-CID "Hemi" V8s. There are three transmissions—a standard three-speed or optional four-speed, both floor-mounted, or an automatic, either console or column-mounted. Driving the Challenger can be either a pleasure or work, depending upon whether you get it in a mild or brute version. But in any event, the heads will turn when this one goes by.

PLYMOUTH: New here is the Barracuda and a little jewel called the Valiant Duster. The Barracuda, available either as a two-door hardtop or a convertible, is a sports/specialty car that's aimed squarely at Mustang and Camaro. And it's an all-

(Please turn to page 220)



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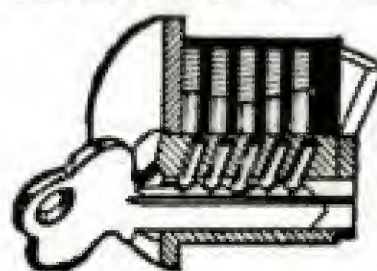
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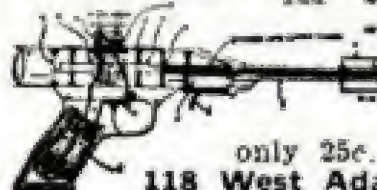


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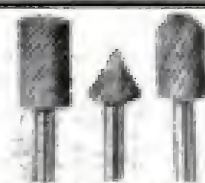
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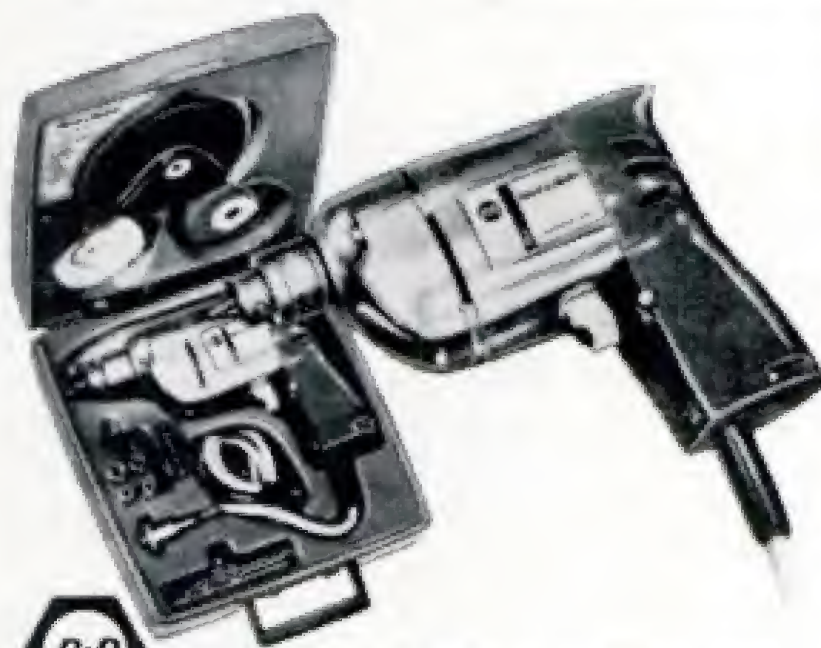
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THE '70 CARS

(Continued from page 217)

new car; don't let the "Barracuda" tag fool you. It's offered in three series—the base Barracuda, the plush Gran Coupe, the all-out 'Cuda. Thanks largely to a unique grille and bumper arrangement, it's a startling looking car, about as "tomorrow" as anything coming out of Detroit these days. Although similar in many respects to Dodge's Challenger—including the engine and transmission lineup—Chrysler's stylists have managed to make it look different. For one thing, it's almost five inches shorter overall, a fact that somehow makes it more . . . oh, *personal*. Again, driving the Barracuda can be pleasing or a chore. It can even be fun. The car handles quite well, although nothing out of the ordinary in either intent or results.

The Duster is something of an enigma. Plymouth didn't bill it as an all-new car, yet by Detroit standards it's as new as anything herein described. True, the Valiant line still includes the four-door sedan, carried over pretty much as is (or was) from '69. And true, the Duster and its companion Duster 340 carry the Valiant label. Yet the latter is a far different breed of cat than the four-door. It's a nifty looking little thing, its two-door coupe styling being "new from the ground up." For real. Coupled with its great looks is what Plymouth promises will be "economy-budget prices" (not announced as this is being written). If it does manage to keep the price down, the Duster could be the sales sleeper of the year. Standard engine in the Duster is a new 198-CID Six. The options include a 225-CID Six and a 318-CID V8. Standard in the Duster 340 is—give up?—a 340-CID 4-bbl. V8, a package bound to make the car big news with the younger muscle-car set. The car is unabashed fun to drive and, like I said, it could be the sleeper of the year. ★★

THE NEW INTERMEDIATES

(Continued from page 114)

trim styling and a wider choice of inside trim colors. Although the 112-in. (coupe and convertible) and 116-in. (sedan) wheelbases are carried over, overall length and front and rear track are up fractions, overall width a fraction down. The hot SS 396 is available only as a coupe or convertible. Standard engines include a 250-CID Six, a 307-CID V8. The options—all V8s—include a 350-CID 2- or 4-bbl., a 396-CID, 400-CID and new 454-CID. There are two manual transmissions—a column-mounted three-speed and a

console-mounted four-speed—and two automatics.

In all, a broad, appealing line.

DODGE: Coronet is the overall name here, although five series of cars are offered—the Coronet Deluxe, 440, 500, R/T, Super Bee. Biggest styling change has overall body length up nearly three inches. There's also a new split grille set behind a new twin-loop bumper. Front fenders are new. In back there's a new deck lid, new tail-light arrangement, new bumper. The base Coronet DeLuxe is available as a two-door coupe, four-door sedan, two-seat wagon. The 440 is offered as a two-door coupe or hardtop, a four-door sedan, two or three-seat wagons. Same with the 500, except a convertible replaces the coupe. The R/T comes as a two-door hardtop and convertible, the Super Bee as a two-door coupe or hardtop. In the Deluxe and 440, standard engines are a 225-CID Six, a 318-CID V8 (this V8 is standard in the 500). The Super Bee gets a 383-CID V8 as standard, the R/T a big 440-CID V8. There are engine options throughout, including the formidable 426-CID Hemi V8. There's a new floor or column-mounted three-speed manual transmission, in addition to a manual four-speed and an automatic.

Dodge did well with these cars last year, taking about 12 percent of the intermediate market. This year should be a winner, too; it's a good looking, snappy line.

FORD: Offered here are the Fairlane 500 and the Torino series—base, GT, Brougham, Cobra. Overall length is up five inches, wheelbase an inch. The hood is longer, slopes more, and rooflines are lower. There are a couple of new grilles. Around back there's a new taillight setup and new backup lamps. Inside is a new three-point lap and seat-belt arrangement, new dash panel, steering wheel. Optional inside are "upbeat interiors," whatever that might mean. The Fairlane is offered as a two-door hardtop, four-door sedan, wagon. The base Torino adds a four-door hardtop. The GT is offered as a two-door hardtop and convertible, the Brougham a two or four-door hardtop and wagon, the Cobra as a two-door hardtop. Standard engine on everything except the GT and Cobra is a 250-CID Six. Standard on the GT is a 302-CID V8. Standard on the Cobra is a 429-CID V8. Other engines available are two 351-CID V8s, one a 2-bbl., the other a 4-bbl. (not in the Cobra, however), and four versions of the 429, ranging from merely snarling to out-and-out nasty. Transmissions include three and four-speed manuals and an automatic.

There's a lot to like here. A bit gim-

(Please turn to page 222)

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THE '70 CARS

(Continued from page 221)

micky in spots, but the overall line is smashing.

MERCURY: Two series here—Montego and Cyclone. In the Montego there's a base model, an MX and Brougham; in the Cyclone, a base, GT and Spoiler. Wheelbase is up an inch, overall length almost four. Tread is wider fore and aft. The hood is longer, rooflines lower. There are new grilles, a new bumper, new rear-end treatment. Inside are new two or three-spoke steering wheels and a new instrument cluster, plus several trim touches. You can get the base Montego as a two-door hardtop or a four-door sedan. Same with the MX, except add a wagon. The Brougham is available as either a two or four-door hardtop, a four-door sedan and wagon. The Cyclone series comes only as a two-door hardtop. Base engine on everything except the Cyclone series is a 250-CID Six. Standard on the Cyclone is a 429-CID V8, on the GT a 351-CID 2-bbl. V8, on the Spoiler a muscle version of the 429. Other engine options include a 302-CID V8, a 351 4-bbl. and an even more muscular 429, available only on two-door hardtops. There's a three or four-speed manual transmission on tap, as well as an automatic.

Here again there's a lot to like from in front. Add Mercury's long option list and you can come up with just about anything you might want.

OLDSMOBILE: Available here are the F-85, the Cutlass, Cutlass Supreme, 4-4-2 and Vista Cruiser wagons. The base F-85 is a sports coupe; the Cutlass a sports coupe, two or four-door hardtop, four-door sedan, convertible and two-seat wagon; the Supreme a four-door sedan, two or four-door hardtop and convertible; the 4-4-2 a sports coupe, two-door hardtop and convertible. In addition there are special "S" dress-up options for the Cutlass, an "SX" (I don't know what it means either) option for the Supreme Holiday Coupe and convertible. The Vista Cruiser wagons are either two or three-seat. There are new grilles, fenders, doors, rear quarter panels, taillights, bumpers front and back. There's a new instrument panel inside along with a lot of "wood grain" facing. Engines include a 250-CID Six, either 2-bbl. or 4-bbl. 350-CID V8s, and—for the 4-4-2—a big 455-CID V8. Transmissions include manual three and four-speeds and an automatic.

As always, the Olds line has a nicely finished look about it.

PLYMOUTH: There are five series here—Belvedere, Satellite, Sport Satellite, Road

Runner and GTX. You'll notice new front and rear bumpers, a new grille, new rear-deck lid, new taillights, a new instrument panel, some new hood gimmickry and new stripe treatment. The Belvedere comes as a two-door coupe, four-door sedan, two-seat wagon. In the Satellite there's a two-door hardtop, a four-door sedan, a convertible and two or three-seat wagons. Same with the Sports Satellite, only no convertible. The Road Runner is a two-door coupe or hardtop and convertible, the GTX strictly a two-door hardtop. Engines start off with a 225-CID Six and go up through 318, 383, 426 and 440-CID V8s. Transmissions are a manual three or four-speed and an automatic.

You'll be interested to know you can get Plymouth's intermediates in any one of 18 colors including—brace yourself—"Vitamin C, Tor-red, Lime-light, In-violet and Lemon Twist." We're in more trouble than I thought.

PONTIAC: Four cars here—Tempest, LeMans, LeMans Sport and GTO. Pontiac's split grille theme has been retained, albeit slightly restyled via a new bumper and parking and side marker-light arrangement. There's not much new inside, primarily a reshuffled instrument panel and some trim touches. You can get the Tempest as a two-door coupe or four-door sedan. With the LeMans add a two-door and four-door hardtop and a two-seat wagon. In the LeMans Sport, drop the four-door sedan and add a convertible. The GTO is either a two-door hardtop or a convertible. The line's standard engine is a 250-CID Six. Optional are 350 and 400-CID V8s, the latter in 2-bbl. and 4-bbl. versions and available only with an automatic transmission. Standard in the GTO is a 400-CID V8 with a 360-hp, 455-CID V8 the option. The OHC Six has been dropped. Transmissions include a three or four-speed manual and two automatics.

There's not too much that's new here, granted, but Pontiac says it's placing a lot of its effort on improving quality. Let's hear it for Pontiac! ★★★

THE PERSONAL CARS

(Continued from page 118)

side, things are pretty much carried over. There's only one engine for the Riviera—a 455-CID, 4-bbl. V8. The car is (as always) a two-door hardtop and the transmission is automatic.

I'm not a Riviera buff per se, but I like this one.

CHEVROLET: Corvette and Camaro are the action here. The Corvette is the same

(Please turn to page 224)

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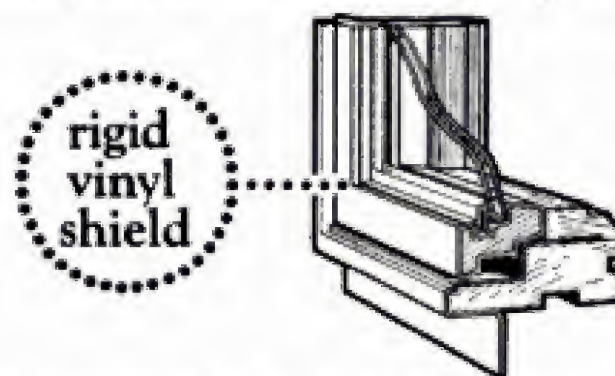
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THE '70 CARS

(Continued from page 223)

coupe and convertible it was last year, which is to say pretty spiffy. There are no real changes outside and strictly minor ones inside. Power is various versions of two V8s—350 and 427-CID engines. There's a manual three-speed, a manual four-speed and an automatic. A nice car, but not for the timid or indiscreet. Camaro, too, is carried over as is. It'll be an all-new car after the first of the year, so Chevy let it ride. It comes as a coupe or convertible in both base and SS versions. There's all sorts of dress-up stuff available, too. In engines there are 230 and 250 CID Sixes, 307, 350 and 396 CID V8s. In transmissions there are two manual three-speeds, a manual four-speed, and three automatics, not all of which are available in all models.

Again, a nice car. I look forward to seeing the new one.

DODGE: Charger is the name of this game. There's a new lower-priced model called—oddly enough—Charger, the Charger 500 and Charger R/T. The Charger Daytona is strictly a race car being built in limited numbers (although, as pointed out earlier, anybody can buy one if a dealer has one to sell). In all series the car is a two-door hardtop coupe. Styling changes are mostly up front and involve a new loop bumper and minor ornamentation touches. The new bumper, by the way, can be color-keyed in hues tabbed "Hemi Orange, Plum Crazy, Banana." Heaven save us! A 225-CID Six or 318-CID V8 are standard on the base Charger and the Charger 500. On the R/T, the standard engine is a 440-CID V8. Optional at the top end of the line is the 426-CID Hemi V8. Transmissions include a three or four-speed manual and an automatic.

Again, it's what it was last time around—a bit brutish, but a head-turner.

FORD: Two cars here—Mustang and Thunderbird. The Mustang has been re-vamped fore and aft, up front via a new grille and fender treatment, in back via a new taillight arrangement. The changes, however, are minor. The car is available as a two-door hardtop coupe, a fastback and a convertible. There's a base Mustang, a dressy Grandé, two muscle versions—the Boss and Mach 1. In engines there are two Sixes—200 and 250-CID—2-bbl. and 4-bbl. 302-CID V8s, 2-bbl. and 4-bbl. 351-CID V8s, two 4-bbl. 428-CID V8s, and an all-out 429-CID V8. Transmissions are a three and four-speed manual and an automatic. The T-bird, on the other hand, has been extensively restyled up front. You'll notice

a brand-new nose appearing at the end of a longer (five-inch-plus) hood. The grille, bumper and headlight setup are new. The car is available as a two-door hardtop, a two or four-door landau. There's only one engine—a 360-hp, 429-CID V8. The transmission is automatic.

Ford went easy with both the Mustang and T-bird this year (despite the latter's new nose job), meaning there are no surprises, just the usual nice and/or elegant touches.

MERCURY: Here we have the Cougar in three series—base, XR-7, Eliminator. The Cougar and XR-7 are available as two-door hardtops or convertibles, the Eliminator only as a two-door hardtop. Styling changes are minor, centering mainly around a new grille and new ornamentation. Inside are new trim schemes, new high-back bucket seats, new two and three-spoke steering wheels. The Eliminator features front and rear spoilers. Engines include 351-CID 2-bbl. and 4-bbl. V8s, a Boss 302-CID 4-bbl., 428-CID and 429-CID V8s. There's a three or four-speed manual transmission and an automatic.

I liked the Cougar when it was first introduced. I still do.

OLDSMOBILE: They've redone the front end of the Toronado, giving it a new grille, new bumper, new headlight arrangement. There's also a new rear-deck lid, new taillight assembly, new rear quarter-panels. Inside there's a new instrument panel and new trim throughout. Here, styling touches really are refinements—a pushbutton ash tray, for example, and rearranged airconditioning outlets. Power is a 455-CID 4-bbl. V8, the transmission automatic.

I've put a lot of miles on the front-drive Toronado, all soothing and comfortable.

PONTIAC: Again, two cars—the Firebird and Grand Prix, both carried over pretty much intact. The Grand Prix was new last year, the Firebird will be after the first of the year. There's really not much to report about either car. The Firebird comes as a two-door coupe and convertible, the Grand Prix as a two-door hardtop coupe. The Grand Prix is powered by 400-CID 2-bbl. and 4-bbl. V8s or a 455-CID 4-bbl. V8. Transmissions are a three-speed manual and an automatic. Firebird power includes a 250-CID Six, 2-bbl. and 4-bbl. 350-CID V8s, two 400-CID V8s (2-bbl., 4-bbl.), a 428-CID 4-bbl. V8, and a 455-CID 4-bbl. V8. Transmissions are a three or four-speed manual and an automatic.

As mentioned earlier, Pontiac is making an effort on the workmanship front, which has to be some of the best news of the year. ★ ★ ★

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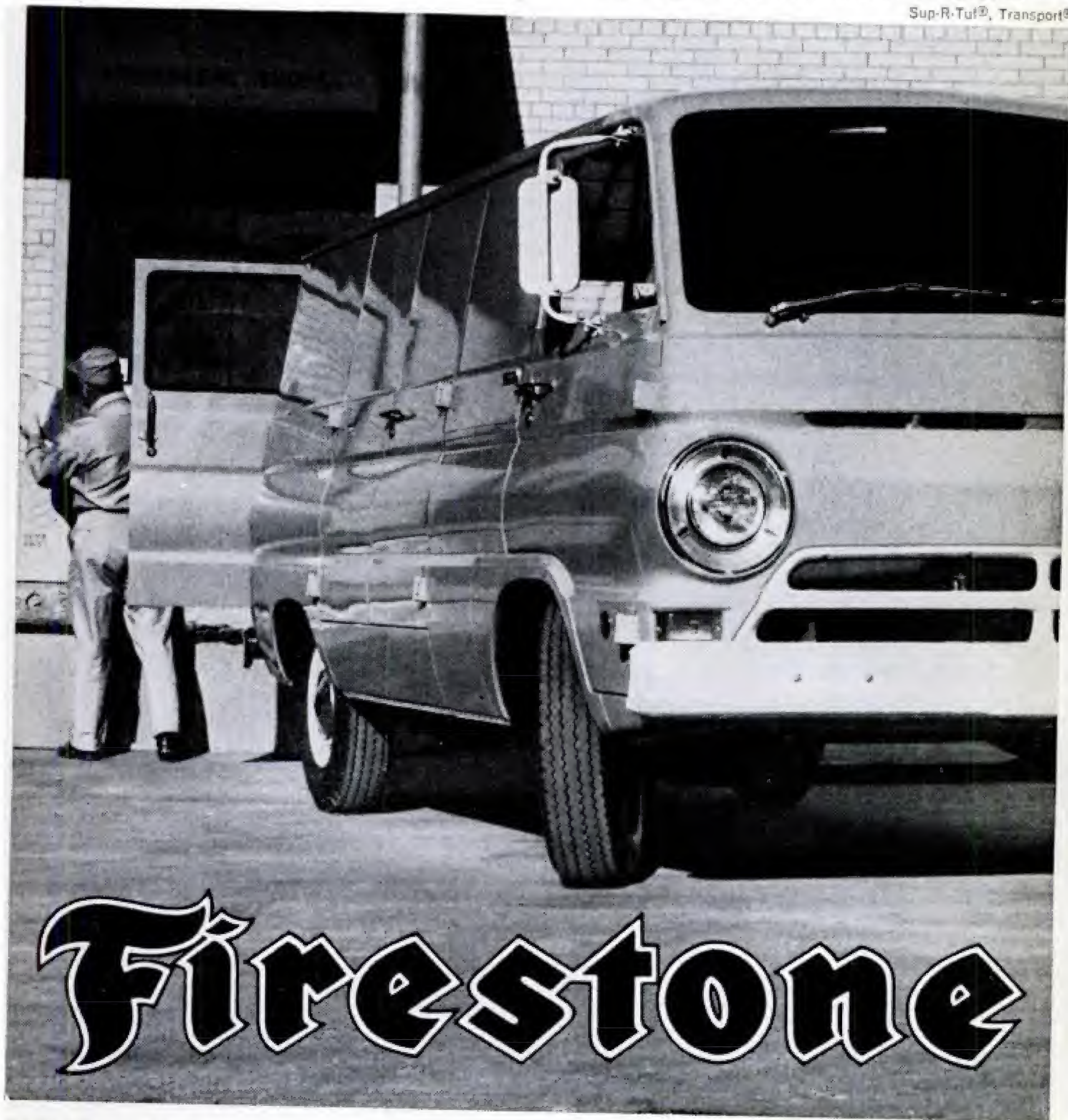
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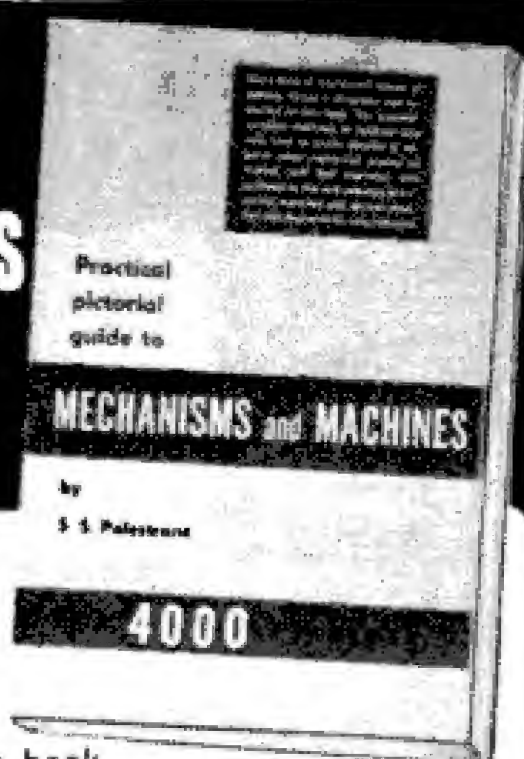
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THE '70 CARS

(Continued from page 230)

Monterey lineup is the same as the Monterey except the wagon is called Colony Park. In the Marquis Brougham you can get a four-door sedan, a two or four-door hardtop. A 390-CID 2-bbl. V8 is standard in the Monterey, Monterey Custom, base Marauder and Colony Park wagon. The Marquis and Marquis Brougham feature a 429-CID 2-bbl. V8, the X-100 a 429 4-bbl. Transmissions are a three-speed manual and an automatic. As pointed out in *The Luxury Cars*, page 123, these cars are becoming more Lincolnesque as the years go by. And I guess that's not bad.

OLDSMOBILE: The hand of the stylist has been stayed on the 1970 Delta 88s. There are new grilles, a new headlight arrangement. There's a new rear bumper. Inside there's a new steering wheel and new decor themes accented via wood-grain appliques. The car comes as either a base Delta 88, a Custom or Royale. The base model is available as a four-door sedan, two or four-door hardtop, a convertible. Same for the Custom, only no convertible. The Royale is strictly a two-door hardtop. There are three V8 engines—a standard 350-CID 2-bbl. and a 455-CID 2-bbl. and 4-bbl. You get a manual three-speed as standard transmission, with an automatic as the option. Optional on the shift lever of all 88s is a fingertip control for the windshield washer/wiper. You needn't take your eyes off the road to turn it on. A good idea on a nice line of cars.

PLYMOUTH: Four series of cars here—Fury I, II and III, Sport Fury. All have been slightly restyled front and rear, mainly via grilles and bumpers. Fury I and II are available as a two-door coupe, a four-door sedan. Fury III comes as two-door hardtops, a four-door sedan and hardtop, a convertible. Same with the Sport Fury, only there's no convertible. New this year is a Sport Fury GT replacing the VIP. It comes only as a two-door hardtop. In addition, there are three wagons—Suburban, Custom Suburban and Sport Suburban, all available as either two or three-seaters. Engines include a 225-CID Six, a 318-CID V8, two 383-CID V8s (2-bbl., 4-bbl.), two 440-CID V8s, a 4-bbl. and a three 2-bbl. Transmissions are a manual three-speed and automatic.

These are big, generous offerings, well worth a look if you're interested in a family-size car.

PONTIAC: You'll notice big changes up front in these cars. There's a new grille, new hood and fenders, a new bumper. Things have been redone in back, too, but

(Please turn to page 234)



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THE '70 CARS

(Continued from page 232)

not as radically. Inside is a new instrument panel, all-new trim schemes. There's a new type of inside door pull on the Bonneville. Cars in the line are the Catalina (a fancy trim option on the Catalina is called the Ventura), the Executive and the Bonneville. The Catalina is available as a four-door sedan, a two or four-door hardtop, a convertible and a two or three-seat wagon. Same with the Executive, but no convertible. The Bonneville adds a convertible, but drops a two-seat wagon. Engines include a 350-CID 2-bbl. V8, a 400-CID 2-bbl. or 4-bbl. V8, a 4-bbl. 455-CID V8. There's a manual three-speed transmission and an automatic.

My personal jury is still out on the revised front ends of these cars, but see what you think. ★ ★ ★

THE LUXURY CARS

(Continued from page 123)

new front end—new grille, bumper, hood. Around back there are new, vertically-mounted backup lamps, one feature of which is that although white, they glow red when unlit. Otherwise, changes are oh-so-slight, the main one being a new rocker panel. The Electra 225 is offered in a base and Custom series. The base model is available as a two or four-door hardtop or a four-door sedan. The Custom offers the same models, but with the addition of a convertible. There's one engine—a 455-CID 4-bbl. V8. A three-speed automatic is the only available transmission. Of all the big cars I've driven, this one somehow "feels" best. For comfort, the Electra is hard to beat.

CHRYSLER: The Imperial was an all-new car last year, and a handsome one at that. They've left it pretty much as is (or was) for '70, adding only slight changes up front with a new grille and minor trim and



BUICK ELECTRA 225 offers somewhat wider, lower look thanks to new grille, hood, wraparound bumper

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LINCOLN CONTINENTAL MARK III remains pretty much the same as when first introduced in mid-1968

ornamentation shifts and additions. The car is offered in two series—the Crown and the LeBaron, both available only as two and four-door hardtops. A 440-CID 4-bbl. V8 is the only engine offered and the transmission is an automatic. I said in these pages last year that I thought the new Imperial was finally competitive with Cadillac and Lincoln in appearance. Apparently buyers agreed; the car did very well, giving Imperial one of its best years. All things being equal, it should do well this year, too. It's an impressive car.

LINCOLN: There are two cars here—the Continental and the Continental Mark III. The Continental has been extensively restyled, particularly up front where you'll notice a new grille, fenders, hood, headlight treatment, ornamentation. Wheelbase is up an inch and front and rear track have been widened. In addition, there's new body-on-frame construction, a new front suspension, new rear suspension. The car is offered in a single series as either a two-door hardtop or a four-door sedan. There's only one engine—the 460-CID V8 introduced last year, the same engine that powers the Mark III. The transmission, of course, is automatic. The Mark III is essentially the same car as when introduced in mid-1968. There are new wheel covers, new bumper reflectors, a new power-operated sun roof, new concealed windshield wipers. The car is available only as a two-door hardtop.

OLDSMOBILE: New for '70 on the Olds 98 is a grille, hood, front bumper, rear bumper, taillight arrangement, some accent molding and striping. In general, however, the car looks very much like it did last year, which is to say, elegant. It's available as a convertible, a two-door hardtop coupe, two four-door sedans and two four-door hardtops. Featured in the top-end models is a 60/40 powered seating arrangement. The one available engine is a 455-CID 4-bbl. V8 and the transmission is an automatic. In common with most cars in the luxury category, power disc brakes and power steering are standard. ★★

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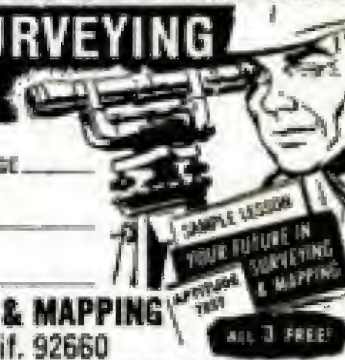
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'70 SNOWMOBILES

(Continued from page 145)

have 125-hp engines, including the Skeeter models and a Bobcat. Skeeter models include the 15½-in. tread for \$1025, a 20½-in. with reverse for \$1275, a 20½-in. with reverse and electric-start for \$1395. The 15½-in.-track Bobcat goes for \$995.

Sno-Jet, a division of Glastron Boat Co., has four new snowmobile series with 15 choices from 12.5 to 35 hp. Heading the line with 15½-in. tracks is the Super Sport with optional electric-start and power ranging from 22 to 35 hp—hot machines that can be used in competition. Jet-Flite, the lowest-power model, has a 12.5-hp engine, sells for about \$699 f.o.b. Quebec. Other models run from the Star-Jet (15 to 19 hp) through the Super Sport to the 18½-in.-track Super-Jet. Sno-Jet's prices range from \$699 to \$1349.

Bolens has four models of the Sprint snowmobile. On 15½-in. tracks, they are available with 297, 315, 340 and 399-cc engines. Model TW-400 has electric-start.

Rupp Manufacturing, Inc. has eight models. Four 15½-in.-track "S" machines have engines of 293 cc (18 hp) to 438 cc (30 hp). Four "WT" models with 17½-in. tracks have electric-start and engines rated at 436 cc (30 hp) and 634 cc (38 hp).

Yamaha has three models—two for the road, one for the racetrack. The small SL 338 has a 24-hp engine on a 15-in. track; the SL 396 a 27-hp engine and 18-in. track, the racing SS 396 a 36-hp engine on a 15-in. track.

Polaris, in its 14th year of building snowmobiles, has a raft of options. You can choose from 17 engines ranging from 150 to 792 cc. You can get a new rigid-frame suspension called Drift Skipper, a new all-rubber track, quieter muffler, redesigned Torque-O-Matic transmission.

Mini-snowmobile of the Polaris line is the Playmate, which weighs 215 lbs., has engines ranging from 150 to 175 cc. Suggested prices are \$575 to \$695.

In its regular line, Polaris has the family-type Mustang with engines of 398 to 744 cc and priced at \$1245 to \$1595. The sporty, lightweight Charger has engines of 293 to 488 cc and prices from \$845 to \$1195. The workhorse Voyager has a 30-in. track and standard 488-cc engine. High-performance machines make up the TX series with engines of 291 to 792 cc.

Arctic Cat has a nine-model, 17-in.-track Panther series, starting with the 290-lb., 14-hp P-246. It uses a torsion-spring and slide-rail suspension system.

Panther models are rated at 20, 25, 27, 33, 40, 55 and 75 hp. Electric-start kits are available for all models except

the P-246. Model prices range from \$895 for P-216 to \$1595 for the 55-hp P-760.

An all-new 2-hp snowmobile called Light-Trac heads the Johnson Skee-Horse entries. Priced at \$995, it has a 437-cc, 25-hp engine, 15½-in. steel-cleat track and a variable-speed, torque-sensing drive.

Two other Johnson Skee-Horse models are the 20½-in. Wide-Trac with a 25-hp engine priced at \$1275 (\$1395 with electric-start) and the Challenger, available with 15½-in. track and 12, 17, 19 or 23 hp.

Montgomery Ward has two models, one a normal-sized Model 370 with a 369-cc engine, coil-spring suspension and 18-in. track. This black and orange machine weighs 382 lbs. and sells for about \$999 or, with electric-start, about \$1149.

For the kids, Ward's has the Mini 99, a 125-pounder with a 99-cc JLO (4½-hp) engine with speed up to 16 mph. It's priced around \$389.

There are five models in the Motor-Ski line made by Industries Bouchard Inc. of Canada, a subsidiary of the U.S. company, Giffen Industries. One is the 295-cc, 15-in.-track Cadet. Others have engines sized from 300 to 634 cc. Most of the primary drive systems have a cam clutch.

Scorpion tops off the horsepower rating with an 800-cc engine on its Mark II Stinger, a 15-in.-track machine also available with 293, 340, 399, 438, 493 and 634-cc engines. Other machines in the Mark series have 15, 18 and 23-in. tracks.

Fox Trac snowmobiles have substantially increased available cc rating—from 227 to 760. The Fox Trac Special has a 15-in. track and 15.5-hp. motor; the Futura series goes from 20.5 to 26 hp. The Centura line, on 18-in. tracks, has engines rated at 23.5 to 28 hp; the Spoiler series, 15 or 18-in. tracks, 26 to 55 hp.

The AMF Ski-Daddler Mark series of snowmobiles looks like it was designed by an aerodynamic engineer. For the novice, there's the Mark IV, a 19½-hp machine on a 15-in. track; for the family, the Mark V, 27 hp, 18-in. track; for the sportsman, the Mark VI, 36 hp, 15-in. track; for racers, the Mark XX, in limited production.

Massey-Ferguson's Ski Whiz has the lowest center of gravity in the business. Three models include the 18.5-hp 300 S, the 22-hp 350 SS and 29-hp 500 SST, all on 15½ in. tracks.

Alouette offers nine machines topped by the 29-hp Competition GTO. Others in the XL series range from the 26-hp Big Bird (electric-start) to the 14-hp XL 20 which runs on a 15-in. track.

Homelite has 11 models ranging from a 9-hp unit for \$555 to a 28-hp electric-start machine for \$1465. ★ ★ ★

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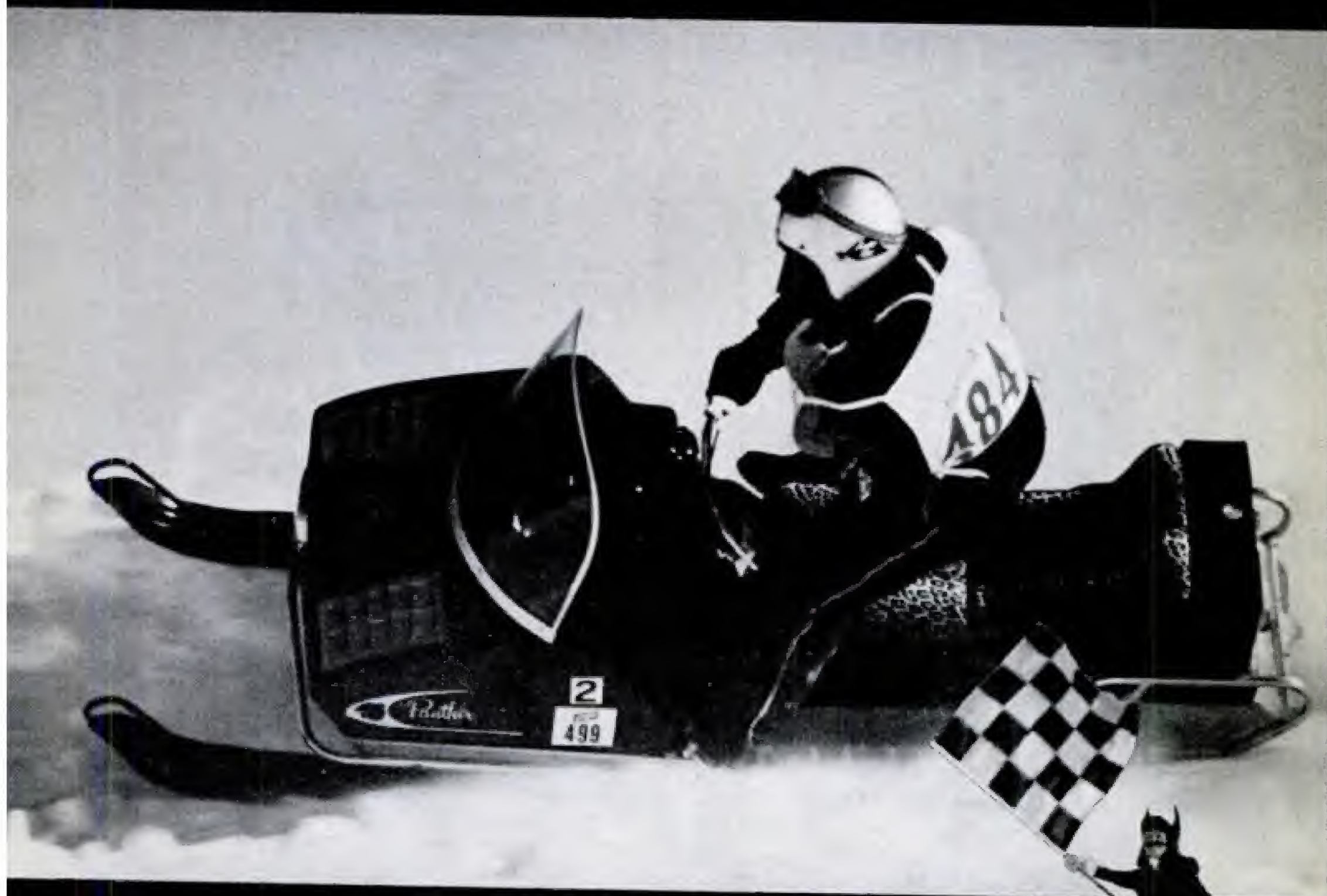
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LANDINGS ON A CARRIER

(Continued from page 99)

down to stay on the glide path and moving laterally to maintain alignment with the landing area center line. An automatic throttle keeps the plane's airspeed steady.

From approximately a third of a mile aft of the ship to touchdown, a factor known as deck motion compensation is employed to synchronize the aircraft with the projected landing point aboard the carrier; in other words, the plane begins to "follow the deck" as it rises and falls, pitches and rolls.

Compensating for deck motion in manual landings is just about impossible—and is, in fact, discouraged—because neither the pilot nor personnel aboard ship can react quickly enough to keep the plane "in tune" with the landing point. As a result, flight deck motion has probably caused more accidents—and more aborted landing attempts—than any other factor in the carrier landing process.

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In combat, the new system will surely save lives. The returning pilot, who may be weary from a tough mission or even wounded, will know that all he has to do to make a safe carrier landing is flip a switch, take his hands from the controls, and relax. ★★★

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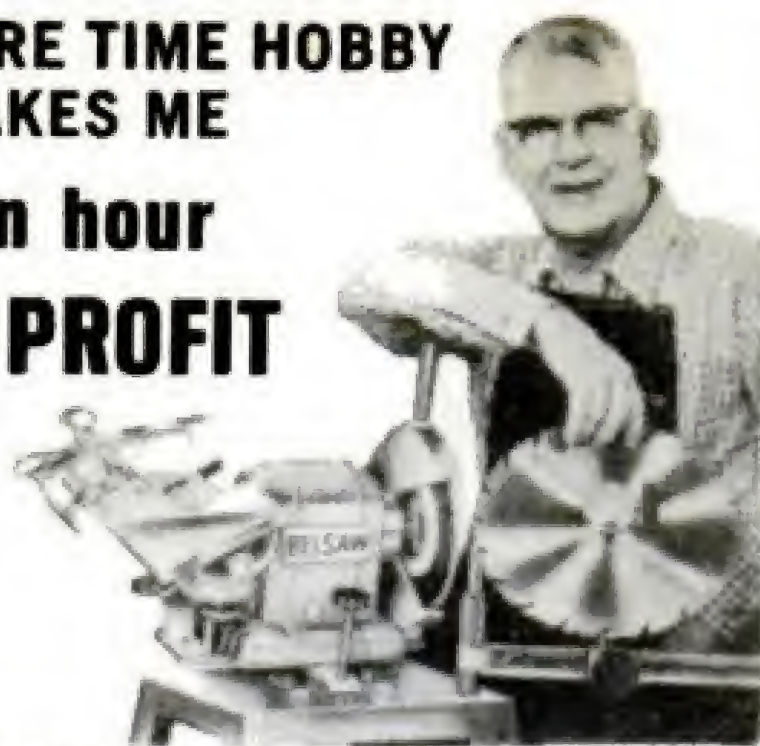
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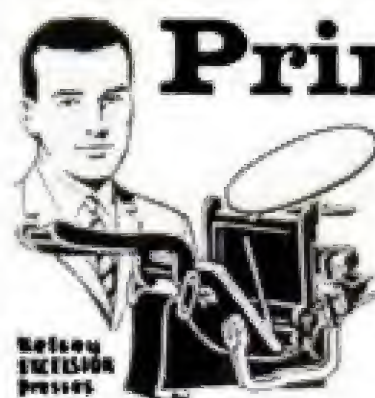
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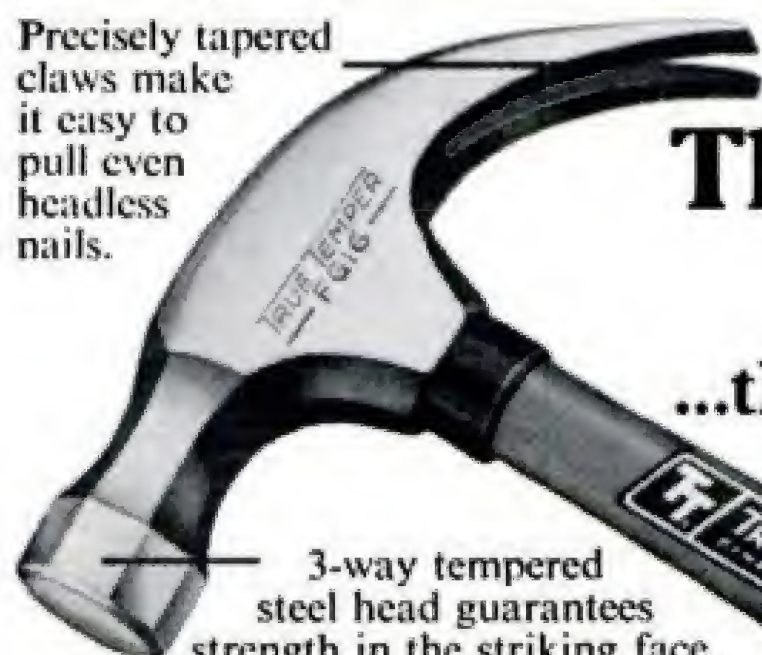
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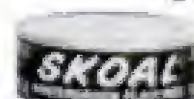
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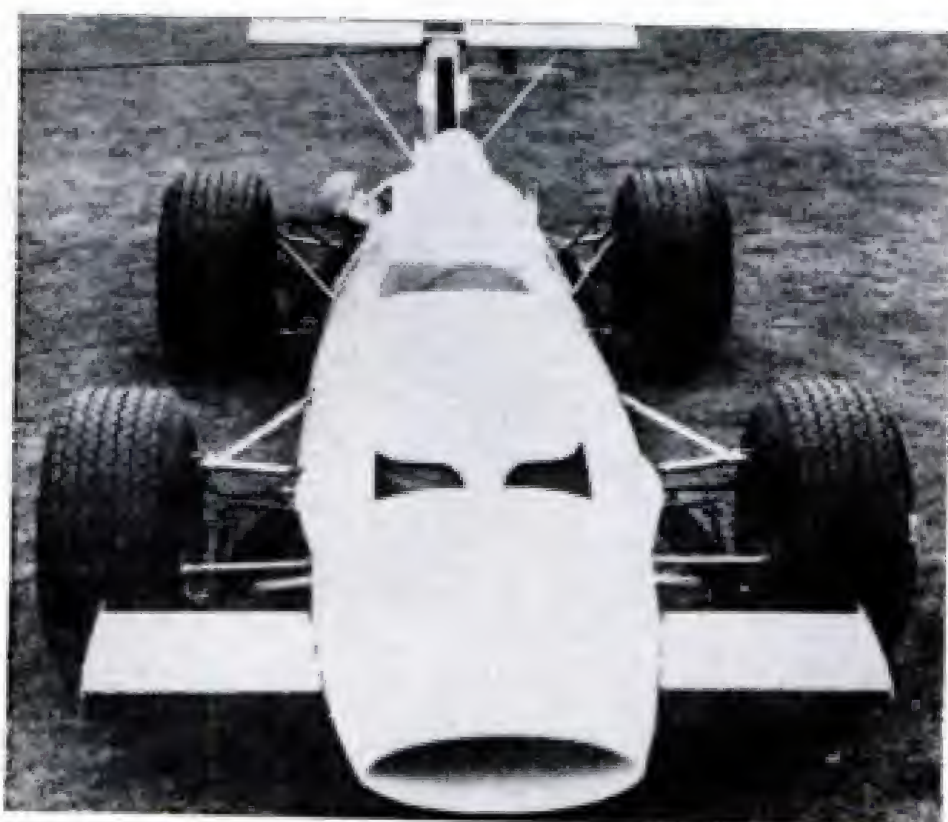


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INSTANT FIRE EXTINGUISHER

(Continued from page 95)

solenoid valve on a tank of Freon, shooting the gas out under pressure to kill the fire—all in a fraction of a second. Electricity for the system can be furnished by battery, such as in a car or boat, or by ordinary current in home installations.

In addition to protecting racing drivers, this remarkable flame-detection system is now going to war. One serious problem in Vietnam has been the loss of expensive vehicles and their personnel to a new enemy weapon: shaped charges. Incorporating these charges, land mines or shells with collapsing noses are designed to lay against the side or bottom of a vehicle where they burn, just like an acetylene torch, right through five or more inches of armor. Typically, these land mines pierce the bottom of a tank or personnel carrier, rupturing gas tanks and spraying fiery gasoline all over the inside.

The government asked Pyrotec to develop a suppression system that would protect both vehicle and personnel. The containers of Freon were supercharged with nitrogen to a pressure of nearly a thousand pounds to produce an extra-fast discharge. A special valve also was devised—a diaphragm with a blank cartridge behind it. When the optical sensor sees a flame, its electrical signal fires the cartridge to blow out this cover and dump the gas with a speed, from detection to discharge, of 7 to 15 milliseconds.

To test the new device, one personnel carrier's bottom was pierced with a land mine fitted with a shaped charge. When the observers entered the vehicle after the explosion, the walls were completely wet with liquid gasoline, yet there had been no fire. Human hair, taped in various areas inside the carrier, was unburned. Another carrier, blasted in the same way, burned for two days.

Even our mighty aircraft carrier, the *John F. Kennedy*, a floating city of 5000 men and nearly five acres of flight deck, utilizes this system to protect her magazines and other critical areas. All military and commercial helicopters are protected by this system. In these choppers, it is located right under the rotor in the engine compartment.

This optical system also protects many commercial jet airliners. In these planes, the device is placed between the engine and the housing around it—a space filled with pipes, tubing, valves, wire and other equipment. The detectors are aimed at all areas where the presence of a fire would mean trouble. In jets, however, the system is not automatic because a false

alarm would actuate the system and kill the engine. This might cause a crash under certain circumstances. Instead, the pilot gets a signal from the system and must decide whether it is a false alarm or not.

In boats with inboard engines, as in racing cars, one of the greatest fears is fire. If the engine compartment of a boat is not adequately ventilated, or if there is a gas leak and gas vapors accumulate, starting the engine can set off an explosion followed by fire. An optical detection system can prevent the fire.

These automatic fire-detection systems are also being used in so-called "glove boxes" where radioactive materials are handled by means of special gloves fitted into sealed containers. An automatic system is essential here because it's impossible to open these boxes with their "hot" contents to get at a fire. The new system is so sensitive it works even when

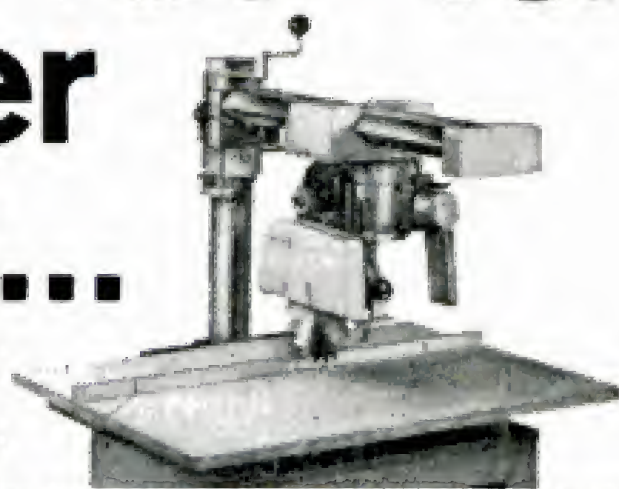
The next area to be protected will probably be you—your car, your boat, your home.

separated from the same by the four-foot-thick zinc bromide or leaded glass window needed to shield workers from the dangerous material inside.

The next area to be protected will probably be you—your car, your boat, your business or your home. While the system is still fairly expensive, it may well go down in price as wider use makes possible quantity production. As of now, it's available in three models from Formula 1 Enterprises, Inc., 37 W. 57th St., New York, N.Y. 10019. System 1, priced at \$600, is completely automatic and can be switched on and off repeatedly. While primarily designed to protect the cockpit of a racing car, it is used by antique car buffs to safeguard the engine compartment of irreplaceable classic cars. The same unit could also be used in a boat or the furnace room in a home.

System 2, slightly lower in price at \$550, is the same as System 1 except that its Freon-release valve is designed only for one-time use—once it's triggered, all the gas is expended at one crack. System 3, the least expensive, is designed for manual operation and does not have the optical infrared sensing mechanism. You press a button to fire the extinguisher yourself as needed. While this doesn't have the automatic protection feature, it still gives you the rapid snuffing out action of the Freon gas. The price for this version is \$200. ★★★

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HOW TO 'PLANE' ON A LATHE

(Continued from page 197)

novelty of this type, but the project illustrates the ability you have to machine unusual surfaces—in this case, conical ones.

To cut them, a lathe bit ground somewhat like a parting tool was clamped in a boring-tool holder mounted in the regular toolpost. The compound slide was adjusted to move at an angle parallel to the funnel side (the funnel itself serving as the setup gauge).

To reduce machining time, the rods were first beveled with a hacksaw to approximate the angle of compound movement. Because of the intermittent action, compound feed was gradual—about .015 in. between passes.

After trimming ends to the desired curvature, the opposite ends were trimmed to uniform length and tinned for soldering.

A similar setup can be used to make special-purpose gouges. Here, the compound slide is usually more nearly parallel to the lathe axis (about 15°), and the distance between rod and lathe axis is reduced in order to produce greater concavity.

Safety tips

In intermittent machining, even with rather slow spindle speeds, the red-hot chips are likely to zing off with considerable force. So it's a must for the operator to wear a face shield or, at least, safety goggles; keep his shirt buttoned at the neck and protect hands and arms to avoid the possibility of entanglement with moving parts. A transparent plastic shield can be mounted on the toolholder or other part to intercept flying chips.

Special effort should be made to mount work and tools so firmly they cannot become unseated. Tools should never be permitted to take oversize bites. The operator and any onlookers should maintain safe distances whenever the lathe is in operation.

Never permit the lathe slide or tool mount to be so loose or sloppy that the tool tends to hog-in when making a cut.

As a rule of thumb, tools can be ground to the same angles as for conventional turning of the same materials. Increased rake might make a tool cut with a smoother shearing action, but might also increase hogging-in tendencies if there is any excessive play or looseness. And because of the setup's unbalanced nature when heavy fixtures are mounted off-center on faceplates, counter-balancing weights may be advisable. ★★

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The greatest detectives in history would be hard pressed to track down somebody to fix a bum toaster or dishwasher these days. It's funny: you have no trouble finding any number of so-called experts who'll fix a leaky pipe or a home run through the picture window. But electrical appliance repairmen are still as scarce as hippies in bathtubs.

If you're lucky enough to get a repairman to come from across town, he'll eventually have your bum dishwasher humming again like bees at a picnic. He'll also present you with an oversized bill. That's where the picnic ends.

If you're in the market for more money you don't need to be a super-sleuth to find it. Look for clues in your own hacienda. If you're typical, you own a couple dozen appliances, counting your wife's hair dryer, power tools and usual plug-ins like air conditioners, toasters, refrigerators, freezers, fry pans, and on and on. A lot of men like yourself have built rewarding full-time businesses after starting part-time earning \$5 and more an hour fixing broken appliances. Others have found full-time jobs as Service Technicians. And when you hit Social Security years, think how great it would be to pick up a little extra cash doing as much Appliance Repair as you cared to do.

The Appliance Division of the National Radio Institute in Washington, D.C., has a great low-cost, home-study course covering every type of Appliance repair in detail—from toasters and irons to air conditioners, refrigeration equipment and one-lung gas engines. There's a section on farm and commercial appliances, too, if you're interested in a big payoff, for when major appliances go kaput, they're as useful as moose antlers on a mouse.

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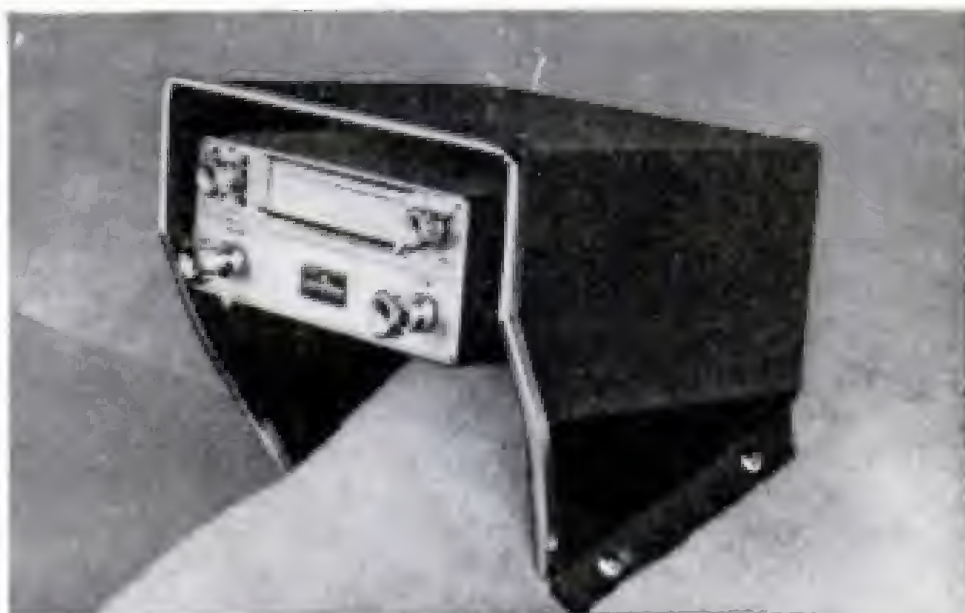


POCKET-SIZED PROBE at left injects a test signal into any RF and IF radio or TV circuit so you can track down faulty parts. By moving the probe from stage to stage until the signal can't be heard, you can pinpoint source of trouble. Probe comes as a kit for \$5.95. Eico Electronic Instrument Co., 283 Malta St., Brooklyn, N.Y.

YOU GET INSTANT WEATHER REPORTS on the midget, single-channel radio at right. Press a button and on comes the official U.S. Weather Bureau forecast, broadcast 24 hours a day on 162.55 MHz. In 3-in. walnut-grained cube, battery-powered transistor receiver has a telescoping antenna, sells for \$14.95 from Radio Shack, Boston.



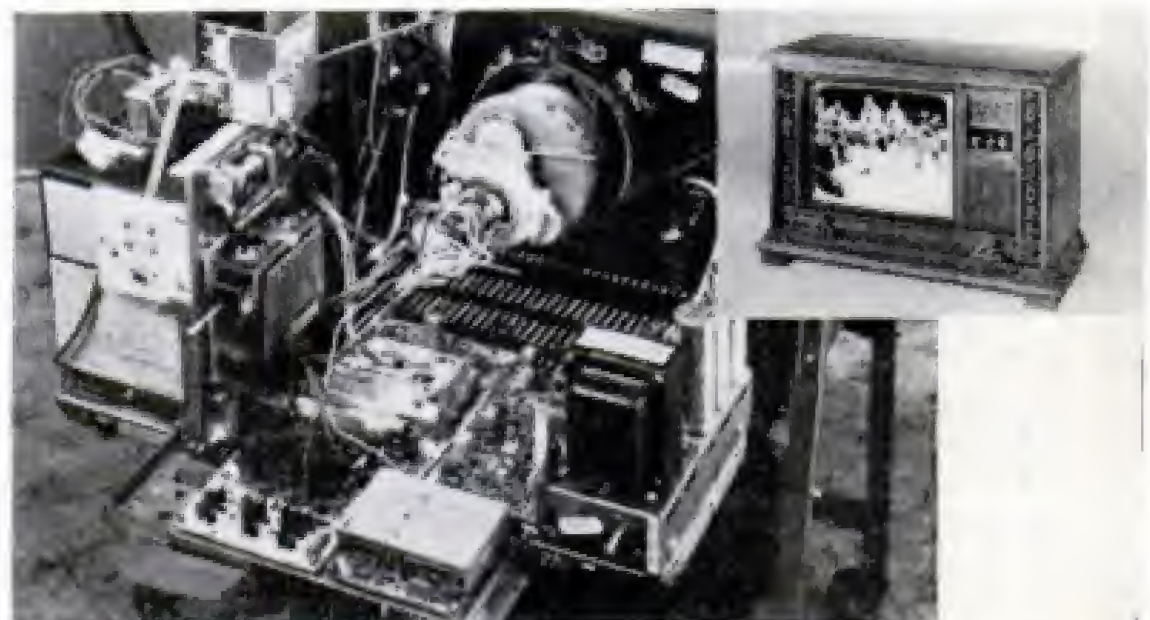
VERSATILE FOGHORN-HAILER for boats can be switched to perform any of five different functions. It serves as a foghorn, a regular boat horn, a loud hailer for calling to neighboring boats and an amplified listener for picking up other boats' calls. With an extension speaker, it's also an intercom. Sold as a kit for \$84.95. Heath Co., Benton Harbor, Mich.



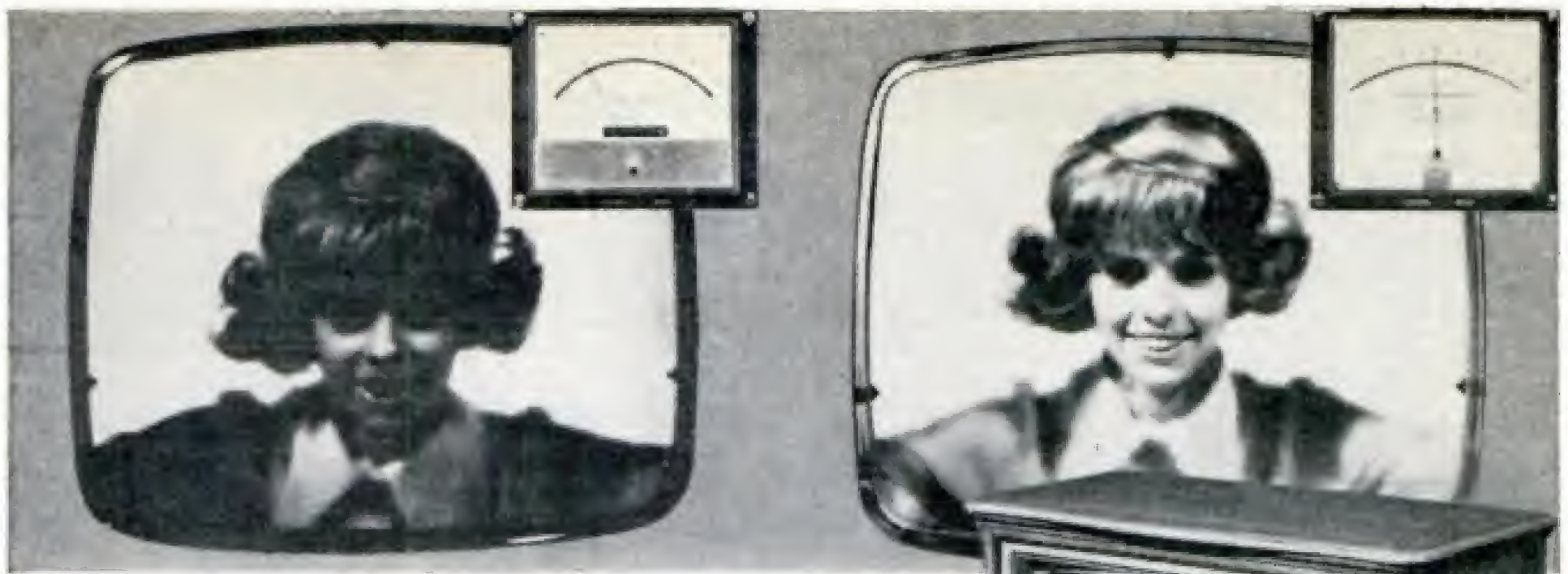
STEREO FLOOR MOUNT makes it easy to install a cartridge tape unit in cars where there's no space in or under the dash. It straddles the transmission hump, putting the machine within close reach of either driver or passenger, and is designed to accept all makes of tape units. Price is \$9.95 from K & R Enterprises, 7242 Sepulveda Blvd., Van Nuys, Calif.



CASSETTE RECORDERS are getting fancier every day. This swank Ampex, in addition to playing its own tapes, has inputs for adding a phonograph, AM/FM tuner or second recorder. It's priced at \$219.95, including stereo speakers. Another model incorporates a built-in AM/FM stereo receiver for \$259.95. Ampex Corp., 2201 Estes Ave., Elk Grove Village, Ill.



PULL-OUT TV CHASSIS is designed for fast, easy servicing in Motorola's new line of Quasar color sets for 1970. All parts slide out like a drawer, and plug-in subassemblies can be removed and replaced quickly without any wiring. Prices start at \$499.95 for 20-in. models and at \$599.95 for 23-in. sets. Motorola, Inc., 9401 W. Grand Ave., Franklin Park, Ill.



TWICE AS BRIGHT as previous types, Zenith's new 23-in. color TV tube at upper right measures 49.5 foot lamberts in tests compared to only 22.8 for a conventional tube at left. The added brightness is achieved by enlarging the electron beams to excite more area of the screen's phosphor dots. A black mask around the dots absorbs reflections, making it possible to use clear glass. In conventional tubes, only about half of each phosphor dot is excited, and dark glass is needed to absorb stray light, reducing picture brightness. TV sets using the new color tube range from \$629.95 to \$950.



PUSHBUTTON SPEAKER SELECTORS are becoming a popular hi-fi accessory. One at lower left controls up to six pairs of stereo speakers throughout the house. It's \$26.95 from Alco Electronic Products, North Andover, Mass. Upper model handles eight pairs of speakers, can be wall-mounted with an adapter plate. It's \$49.50 from Switchcraft, 5555 N. Elston Ave., Chicago. Both controls can also be used for switching inputs into an amplifier.

POP-UP TV SCREEN is the newest feature on a solid-state portable to be sold soon by Panasonic. For easy carrying, the 5-in. screen folds down into the case, making a compact package weighing less than 15 pounds. The battery-powered portable includes an AM/FM radio and a telescoping antenna. A 115-volt adapter lets you run the set at home on house current and recharge batteries at same time. Price to be announced later.



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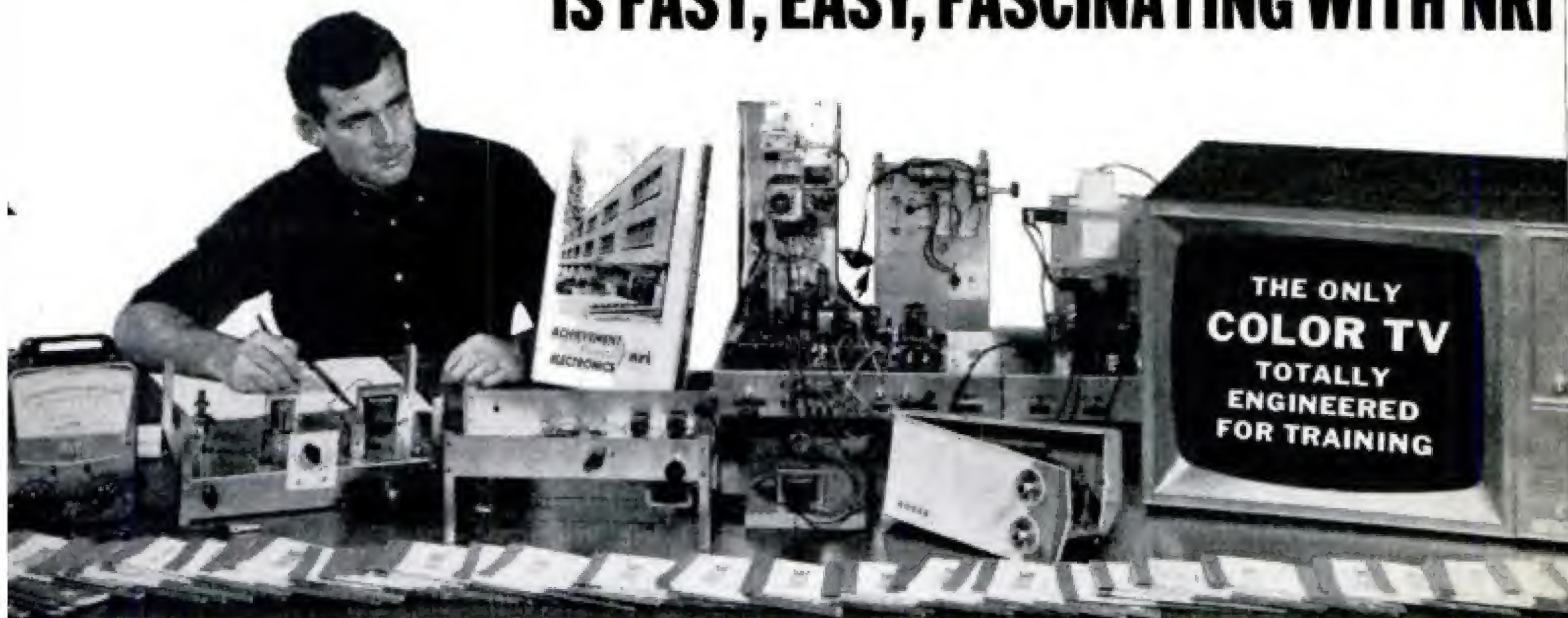


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THE '70 CARS

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(Continued from page 122)

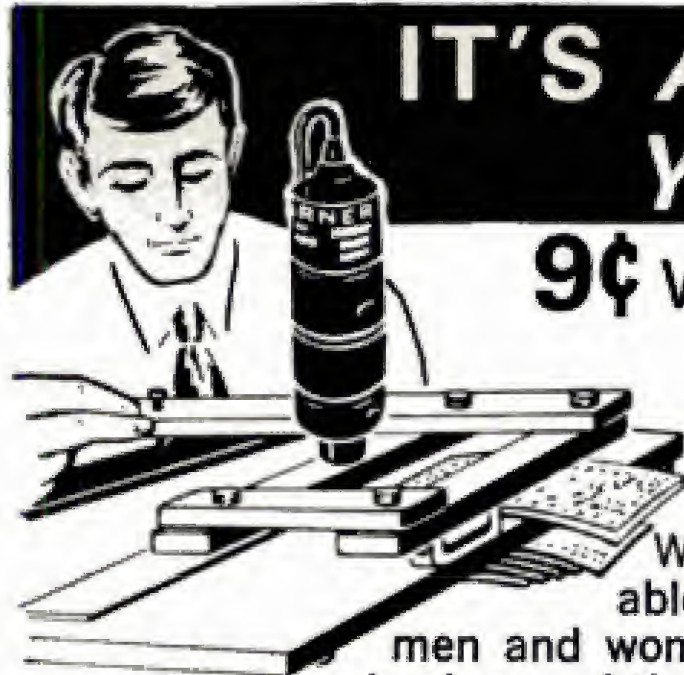
lengthened three inches, the rear end shortened four, tending to give both the Monaco and Polara a longer, lower look. Actually, however, the car is an inch shorter overall. The rear track has been widened three inches. There are new bumpers front and rear and grilles have been slightly restyled. You can get a base Polara as either a two or four-door hardtop, a convertible, a four-door sedan or a two or three-seat wagon; a Polara Custom as a two or four-door hardtop and a four-door sedan; the Monaco same as the Polara less the convertible. Engine lineup for the big Dodge includes a 318-CID V8, a 383 2-bbl. V8, a 440 4-bbl. with either single or dual exhaust. In transmissions there's a new three-speed manual and an automatic. Again this year Dodge is going to go it alone with Super-Lite, an auxiliary light option available only on the Polara and Monaco.

FORD: There are six series offered here—the base Custom, Custom 500, Galaxie 500, XL, LTD, and LTD Brougham. The base Custom can be either a four-door sedan or a Ranch Wagon. Same with the Custom 500 except there's another wagon featuring dual-facing rear seats. The Galaxie comes as a four-door sedan or hardtop, a sport roof or formal two-door hardtop and two wagons. The XL is only a two-door hardtop or convertible. In the LTD, you can get a two or four-door hardtop, a four-door sedan and two Country Squire wagons. The fancier LTD Brougham is available as either a two or four-door hardtop or a four-door sedan.

Styling changes are slight throughout the line with most of the emphasis being placed on new ornamentation and new exterior colors. The XL and LTD have new grilles, and the Brougham, of course, is a new series. Engines include the 240 Six and 302, 351, 390 and 429 V8s, the latter in both 2 and 4-bbl. Transmissions include three and four-speed manuals and an automatic.

MERCURY: Here we have the Monterey, Monterey Custom, Marauder and Marauder X-100, Marquis and Marquis Brougham. All have new grilles, rearranged rear ends, revised ornamentation overall. In general, however, styling changes are slight. You can get the Monterey as a four-door sedan, a two or four-door hardtop, a convertible and a wagon. Same with the Monterey Custom, but no convertible. Both Marauders come only as two-door hardtops. The

(Please turn to page 232)



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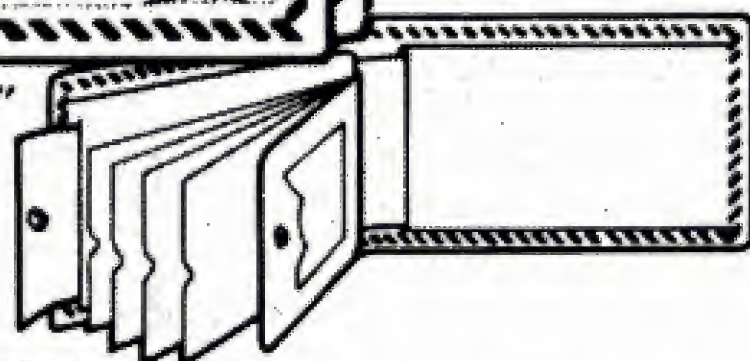
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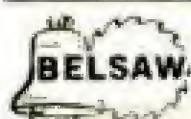


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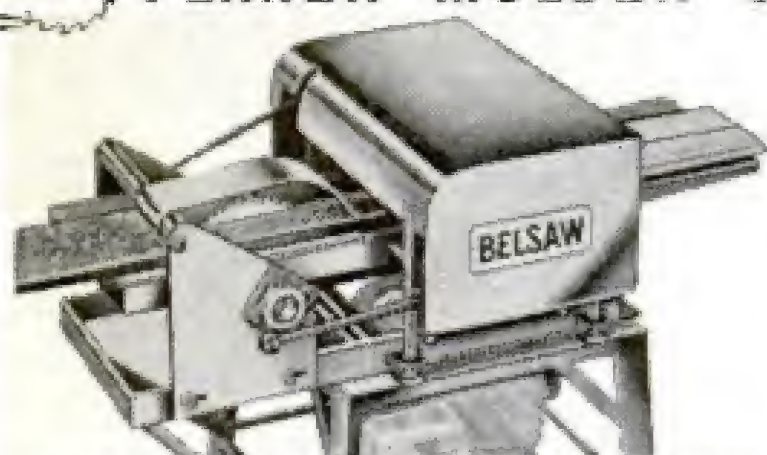
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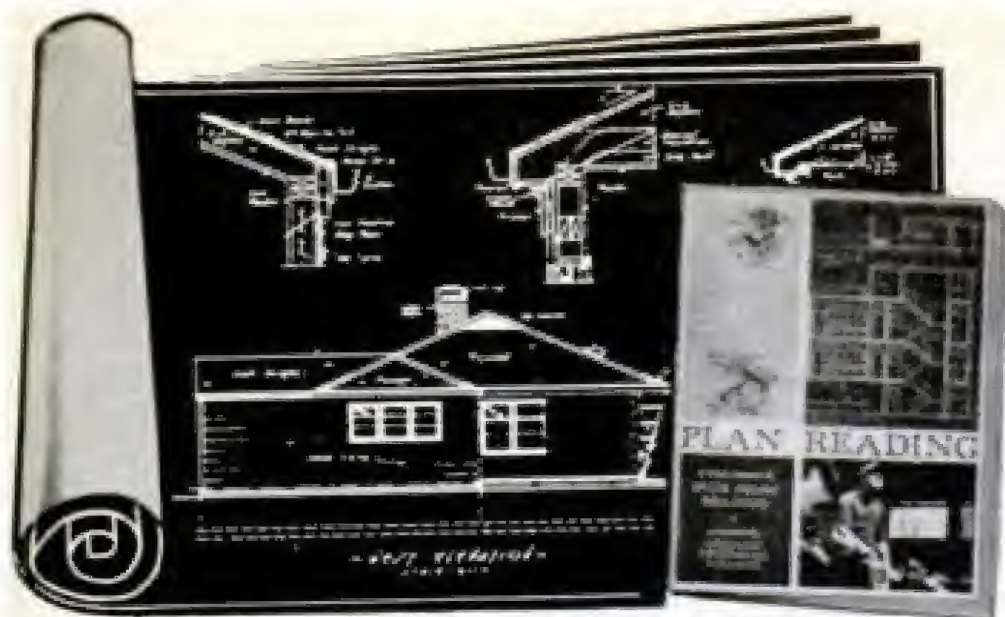
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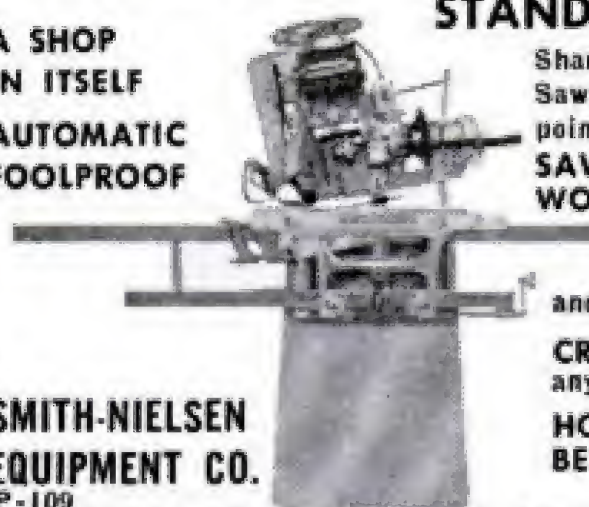
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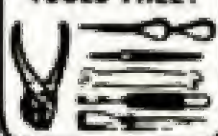
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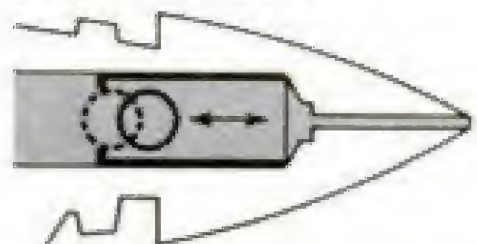
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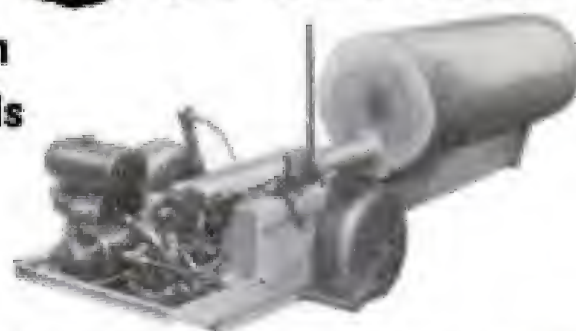


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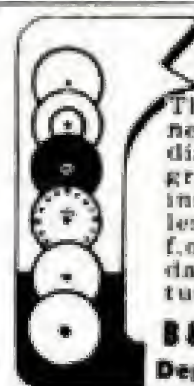
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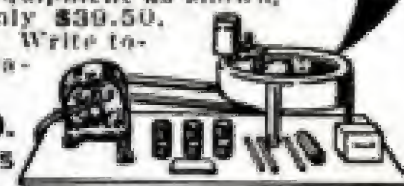


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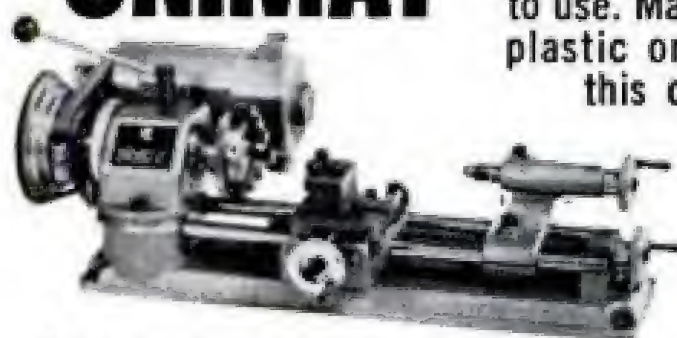
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The Man Who Made Bentleys



AT THE WHEEL of a 1922 Bentley is W. O. Bentley, founder of the firm

IT'S JUST 50 YEARS since Bentley Motors Ltd. was founded (on Jan. 19, 1919, to be exact). In the years between 1921 and 1931 the company produced a total of only 3062 cars, but it was enough to start an empire and a mystique that still flourishes. In 1931, mainly because of Britain's nationwide "slump," the firm went into liquidation; Rolls-Royce bought it out and made it a subsidiary company. But the mystique survived, and today an aura of almost fanatical devotion surrounds the company's founder and the cars.

W. O. Bentley retired many years ago and now lives in a small cottage in Shamley Green, Surrey, England. Alert and healthy at 80, he lives quietly with his wife and two dachshunds. "I don't do much motoring," he says. "If I do, I'm driven by somebody."

It's a long time since the glorious days of the 1920s when the dark green racing Bentleys dominated the racetracks of the world and became famous for their raucous exhaust noise and their daredevil drivers—the "Bentley Boys." W.O. himself last competed in a race in 1922.

Today the Bentley memory is kept alive by the official Bentley Drivers Club, which has a worldwide membership of well over 2000. Owned by club members are more than 1000 vintage Bentleys.

Once described as the most brilliant designer of cars that England ever produced, W.O. Bentley is now, says one acquaintance, "probably Britain's most unrewarded man." Having lost practically all his money in his firm's crash, he now lives on a pension of \$1200 a year.

—Jon McCaughey

1922 BENTLEY, owned by Cyril Wadsworth (left), stands beside W. O. and new Bentley produced by Rolls-Royce



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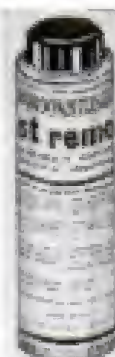
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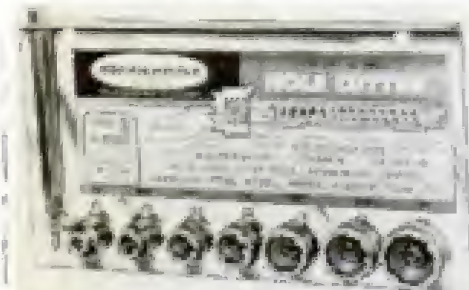
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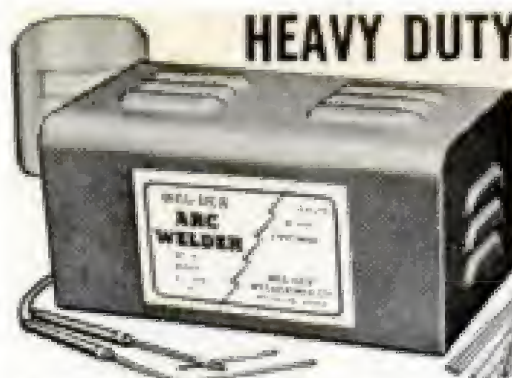
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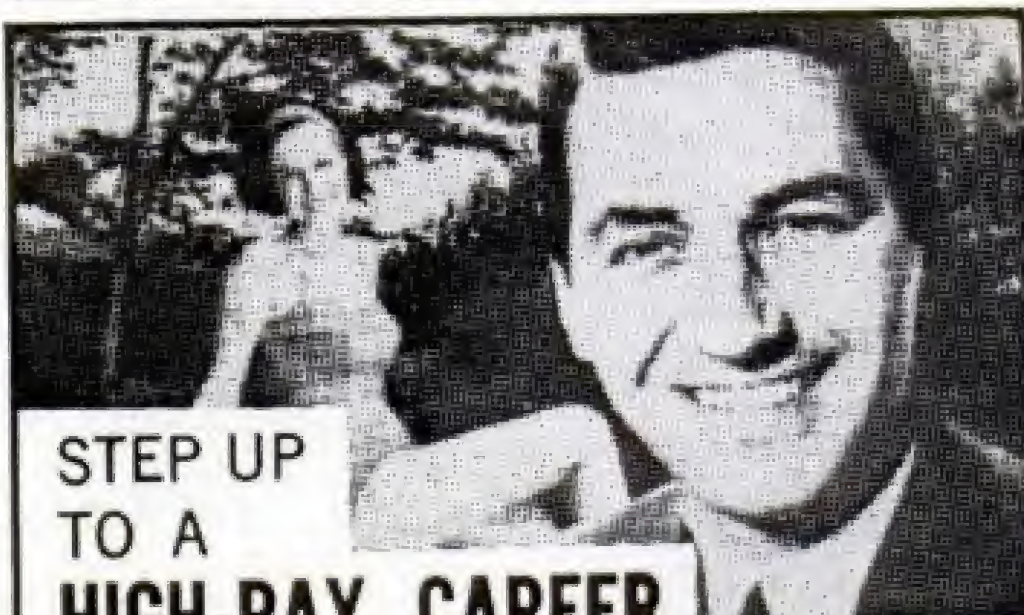
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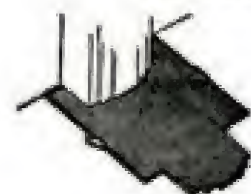
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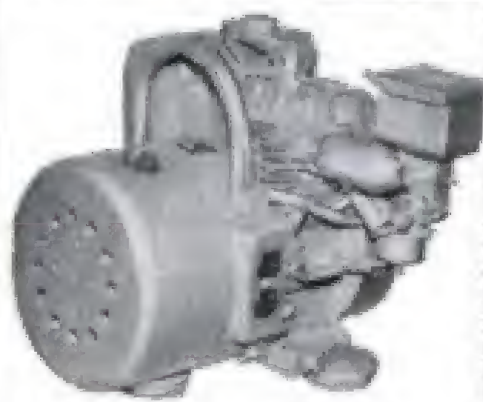
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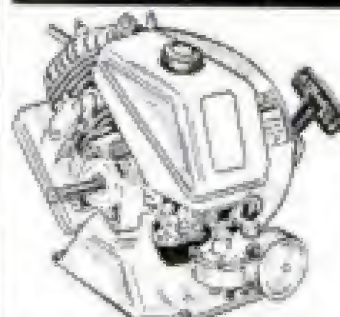
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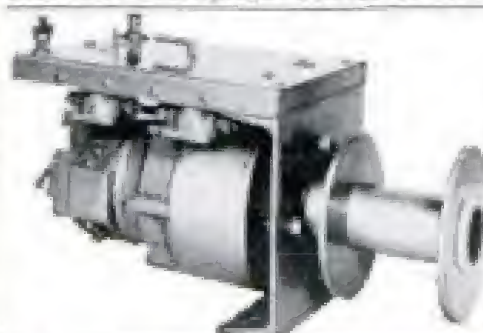
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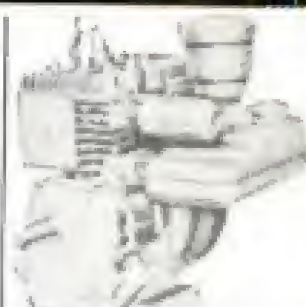


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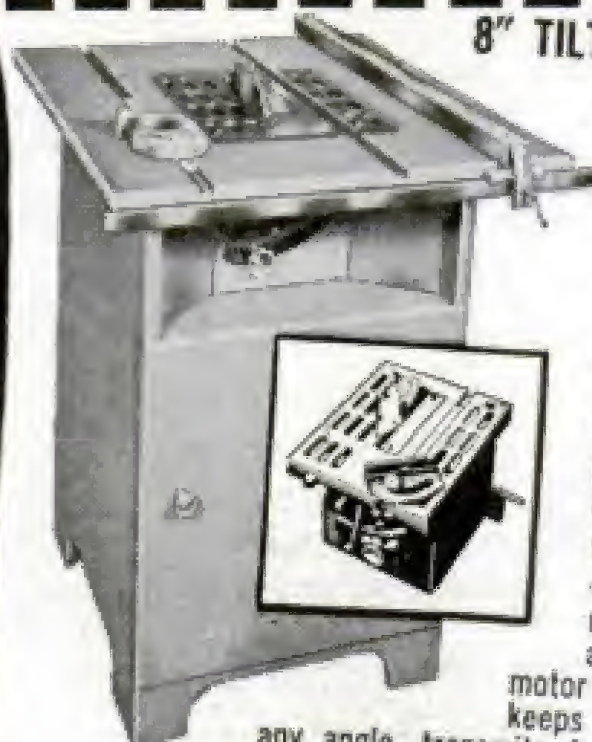
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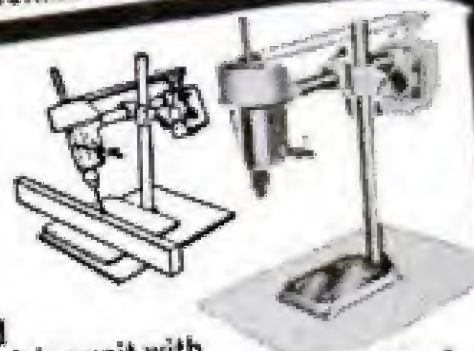
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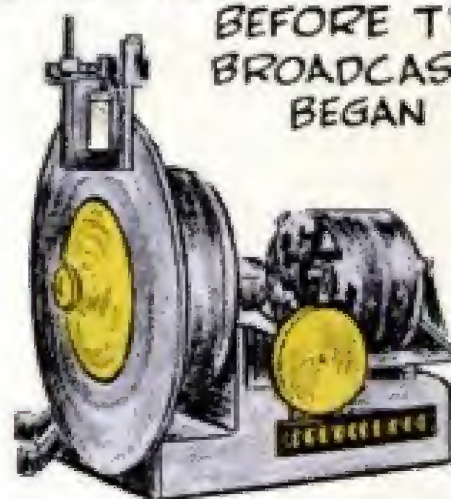
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